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**RESEARCH and DEVELOPMENT TECHNICAL REPORT**

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***A First-order Computational Model of  
Human Operational Planning***

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**U. S. ARMY COMMUNICATIONS-ELECTRONICS COMMAND**  
**Fort Monmouth, New Jersey**

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# **A FIRST-ORDER COMPUTATIONAL MODEL OF HUMAN OPERATIONAL PLANNING**

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## **ABSTRACT**

Most computational models of planning developed within AI require complete and accurate knowledge of the starting situation as well as a well-defined goal for their operation. In marked contrast, human planners often must create plans despite the fact that the goal is often ill-defined and knowledge about the world in which the plan is to be executed is incomplete and possibly inaccurate. Battlefield planning is certainly a paradigmatic example of such a planning context. Consequently, the development of a model of how planning takes place within this type of domain represents a considerable challenge to our current computational understanding of planning. The research reported here is directed at this challenge. Based on observations made of the planning activities of human experts at the U.S. Army War College and a review of the pedagogy associated with the training of human experts, the present paper provides a basic first-order model of the possible control strategy employed by experts in battlefield planning. Next, the proposed model is evaluated by comparing its "predictions" concerning the types of planning activities that should be observed and the order in which these activities should appear against a protocol of the planning activities of human experts. Implications of this first-order model for further knowledge acquisition and development of planning aids are discussed.

## INTRODUCTION

Most computational models of planning developed within AI require complete and accurate knowledge of the starting situation as well as a well-defined goal for their operation. In marked contrast, human planners often must create plans despite the fact that the goal is often ill-defined and knowledge about the world in which the plan is to be executed is incomplete and possibly inaccurate. Battlefield planning is certainly a paradigmatic example of such a planning context. Consequently, the development of a model of how planning takes place within this type of domain represents a considerable challenge to our current computational understanding of planning.

The research reported here is directed at this challenge. The focus in our present research is primarily descriptive. The goal at this stage is simply to try to identify a plausible high-level description of the basic control cycle that might adequately characterize the observed planning activity of human experts who are given a battlefield planning problem. The research has proceeded by observing the planning activities of human experts, reviewing the pedagogy associated with the training of human experts, and then partially specifying a first-order model of a planning strategy that is suggested by these observations and Army doctrine. Next, the proposed model is evaluated by comparing its "predictions" concerning the types of planning activities that should be observed and the order in which these activities should appear against a protocol of the planning activities of human experts.

### *Battlefield Planning*

Battlefield planning is an activity carried out at a variety of communicating levels of the Army command hierarchy. A higher level communicates to a lower level what can be thought of as a partial specification of a subproblem to be solved, a partial specification of the resources available for use in solving the given subproblem, and often a partial specification of aspects of how the subproblem is to be solved. Further, at each level of the command and control hierarchy, several experts are involved in the planning process. Information and decisions may be completely shared within a level whereas only limited communication is possible between levels. The planning itself may take place over a matter of days and the resulting plan provides the basis for coordinating and controlling the activities of many agents over a protracted period of time. Although planning is distributed over many agents with a relatively low-bandwidth of communication

between levels, common knowledge about doctrine and general principles of battle seems to compensate for this low band-width.

In this research we have focussed on only the planning activity that is carried out at what corresponds to the corps level within the Army's command hierarchy. Clearly, the nature of the planning carried out at any level is influenced by the overall structure of this command hierarchy. However, we will not attempt to characterize the planning process as it moves from one level of the command hierarchy to another.

### **A Review of Some of the Standard AI Models of Planning**

It is useful to briefly characterize the control structure used in some of the models of planning developed within AI. This characterization will enable us to see some of the similarities and differences between these models and the model of control suggested by our investigation of the corps battlefield planning problem.

The method of problem reduction is the underlying search model used in most AI research on planning. In this method a problem is recursively decomposed into a set of subproblems. A subproblem consists of a problem state-pair where the first element,  $I_j$ , specifies the starting state or context for the subproblem and the second element,  $G_j$ , specifies the goal state for the subproblem.<sup>1</sup> The search is in a space of possible problem decompositions. Rules, referred to as non-terminal rules are used to map a subproblem into an **AND**ed set of presumably "simpler" subproblems. A primitive subproblem is one for which the system can directly produce the solution or can find a solution with only a "trivial" amount of search. These rules serve as the generators of the space of possible decompositions. The recursive decomposition of a problem yields an **AND** tree that represents one possible decomposition of the given problem in this space of possible decompositions. An alternative decomposition of a problem or subproblem is represented as an **OR** branch. The resulting **AND/OR** tree represents the nondeterministic search over alternative candidate solutions to a problem. Rules referred to as terminal rules serve as recognizers of "primitive" subproblems. A partial derivation of a solution to a subproblem refers to an **AND**ed subtree in this **AND/OR** tree. A derivation is complete if each of its terminal elements has been recognized as a primitive subproblem.

A candidate solution is generated through the above described process of decomposition. A candidate solution is tested via a process of composition. Composition is also a recursive process, but in the standard case the

recursion moves from the terminal elements of the **AND** tree representing a derivation to its root. Composition succeeds if at each level of the **AND** tree the **AND**ed subproblems imply the parent subproblem. Thus, decomposition constitutes the generate phase and composition the test phase in this generate-and-test paradigm.

The simplest adaptation of the reduction method to planning problems is exemplified by the so-called linear planners. Here search is controlled via a depth-first search where the decomposition phase is applied recursively until a primitive subproblem is encountered. The decomposition phase involves only goal decomposition. Consequently, the subproblems created during the recursive application of goal decomposition are only partially formulated; that is, the initial state,  $I_j$ , of a subproblem state pair is not specified. Rather, in this linear planning method the initial state,  $I_0$ , of the original problem state-pair remains fixed until a primitive subproblem is encountered. A subproblem is recognized as primitive if it can be "achieved" by some action whose preconditions are true in the current  $I_j$ . The action is then used to map the current  $I_j$  into a next element which then serves as the specification of the  $I_{j+1}$  associated with the next subproblem. Thus the formulation of subproblems is closely coupled with the search for a solution. If this next element implies the parent subgoal then the test of this part of the derivation has succeeded. If it fails to imply the parent subgoal, then backtracking is used to achieve the search through the space of alternative decompositions. Backtracking allows the reordering of subgoals that have been created at this state of the recursion or if reordering fails it allows for the generation of alternative goal decompositions. Note that because of the possibility of subproblem dependence this search method must potentially search not simply the space of decompositions, but rather a space of permutations of the space of decompositions. Thus, the efficiency of this search heavily depends upon whether or not subproblem dependence is "frequently" encountered. A problem solution consists of a linear ordering of a sequence of actions and it is this linear sequence that is identified as the plan.

So-called non-linear planners alter this control by introducing a test or composition phase at each level of the decomposition. Again the decomposition operation associated with this method is goal decomposition rather than a full problem decomposition. In this method the initial state,  $I_0$ , of the starting problem serves as the initial state for all of the subgoals introduced and is never explicitly altered. The test is accomplished via a process of critiquing. Critics can be thought of as a set of predicates defined over n-tuples of subproblems where n is greater than or equal to

two. These tests are used to detect subproblem dependence. If some  $k$  subproblems are found to be dependent, then an ordering of these subproblems is sought that accommodates the dependency. This ordering is then imposed on any further derivation of a solution. This constraint on the ordering of subgoals serves to implicitly specify the initial state,  $I_j$ , associated with each subgoal. Through this method of repeated critiquing, this control strategy defers commitment to an ordering of the subproblems until a discovered dependency requires such an ordering. A solution is obtained when only primitive subproblems remain and an ordering has been identified which satisfies the critics. The ordering may be only a partial ordering of the actions.

A final method of planning involves the posting of constraints to annotate the existence of a subproblem dependency. This annotation is used to control the choice of which subproblem to expand. The structure added by this annotation explicitly changes the representation of the derivation from that of a tree to a graph. This complication to the structure of the derivation is handled implicitly in the control structure used in linear and non-linear planning. By making this dependency structure explicit in the derivation, this method can more flexibly control search and enforce a policy of least commitment. However, the constraint propagation mechanism must be invoked after each decomposition in order to update these constraint expressions. This least commitment approach allows the plan to be developed via a process of successive refinement. The policy is to refine first those subgoals that are currently most constrained. As in the non-linear planning method, the full formulation of the  $I_j$  associated with a subgoal proceeds incrementally as a result of constraint propagation. The test and solution provided by this method is also analogous to that of the non-linear planning method. A complete solution has been derived if each node has been expanded to its terminal level and a consistent set of constraint expressions holds over the derivation. The partial ordering of the solution is imposed by the constraint expressions.

In all of these approaches to planning, it is assumed that the initial problem is well formulated; that is, that both the  $I_0$  and  $G_0$  defining the problem is fixed and complete. Each of these planning methods "discovers" implications of this starting information as it carries out the planning process. This discovery occurs primarily during what we have termed the test phase of the planning operation. Whether through action simulation, critiquing or constraint posting and propagation, the new information that is derived is primarily information about subproblem dependence. Note that because of the existence of subproblem dependence it is very difficult to search for and maintain multiple derivations of a solution to a problem or subproblem.

Consequently, all of the planners use some variant of a depth-first, or best-first, search.

### **A First-order Model for Corps-level Planning**

The most striking difference between corps battlefield planning and the situation presumed by AI models of planning is that in the case of battlefield planning the planner is not presented with a completely specified problem. Both the relevant information upon which to base the plan, the problem starting state, and the problem goal state is only partially and indirectly specified.

First, with respect to the starting state of the problem, there is an enormous amount of information that is potentially relevant to the creation of a battlefield plan. This includes information about the terrain, enemy force characteristics and disposition, own force characteristics and disposition, enemy plans and intent, weather information and the like. Some of this information may be directly available, and, other information may be developed only through a complicated process of assumption and inference. The commander's guidance does not specify which of this information must be developed to adequately formulate the problem. The planner is expected to do this. Rather what is provided is general information concerning where and over what period the battle should be fought, which own forces may be committed to the battle, and intelligence guidance on which enemy forces may be committed and where and when they may be committed. There may also be intelligence information concerning the enemy objective.

Similarly, the goal of the plan is typically specified in a fashion that, from the AI planning perspective, is a quite abstract and partial. The planner is given bounds concerning when and where the objective is to be achieved and at what cost, rather than a detailed specification of the goal.

Now in the standard AI planning models, the determination of which of the information about the planning situation is relevant is discovered as part of the planning process. Relevant information is developed and associated with a subproblem in three ways. First, and most typically, information defining the subproblem is inherited from the parent subproblem. This is simply the standard mode of subproblem definition provided by the method of problem reduction. Second, information may become available as a result of simulating the effects of already planned actions which precede the current subproblem. We noted the use of this state simulation mechanism in our discussion of linear planning. Third, a subproblem may be further specified

as a result of constraint propagation that occurs when another subproblem is further refined.

Although any of these mechanisms of subproblem specification may be used in battlefield planning, they do not appear to be sufficient. Rather, battlefield planning appears to involve the necessity of explicitly developing the information required to further the planning process. There is some sense in which the planning process provides a way of recognizing the information required and thus focussing efforts at data retrieval, inference or further data collection. This interplay between planning and data development is probably not atypical of human planning in complex information-rich domains. It is of particular interest in the battlefield domain because the process is not simply one of data retrieval, but also one that can involve complex inference strategies initiated to support the planning effort.

From the point of view of planning, this raises the question of exactly how such processes of retrieval and inference might be incorporated into the basic control structure of a planner. There are two basic ways in which a process that further specifies the information associated with a subproblem might be invoked during the control cycle of a planning model. The first is "triggered" and the second is "predictive".

In the triggered case, a subproblem is chosen and the failure to identify any applicable reduction rule to decompose a given subproblem might provide the basis for recognizing that further information about that subproblem must be acquired. Here a failed rule of decomposition presumably provides the basis for determining what information is currently relevant to the derivation of a particular candidate solution. The interesting side-effect of this method of initiating a process of retrieval and inference is that the planning process itself can strongly bias the development of the information that is deemed relevant to the evolving plan.

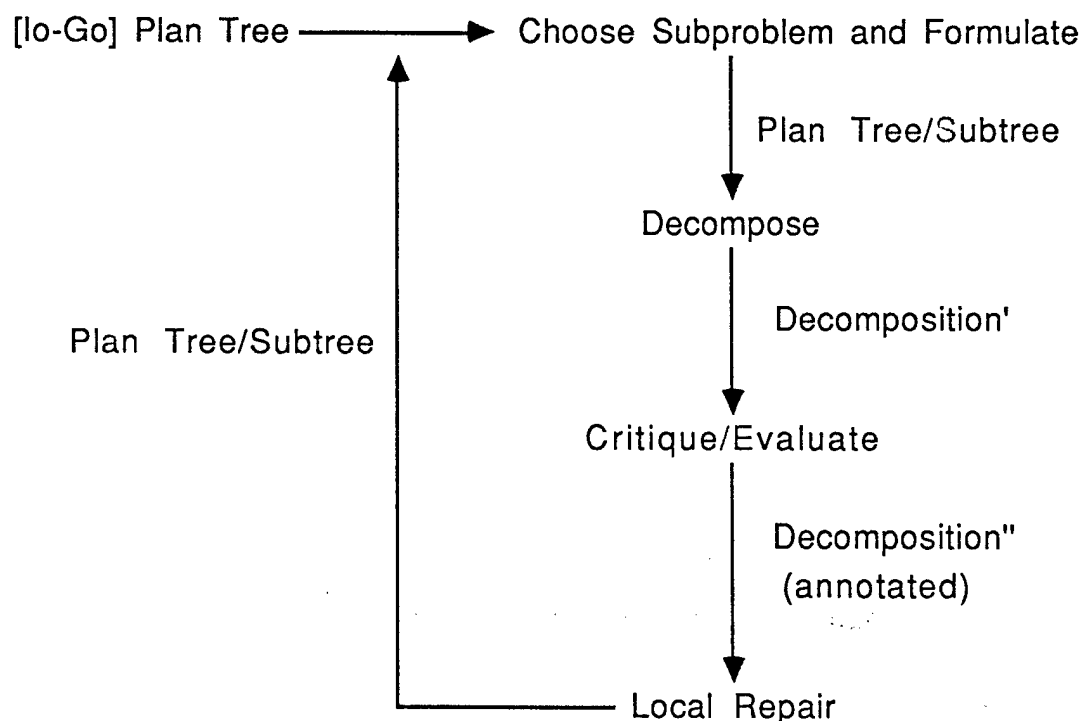
In the predictive case, a subproblem is again chosen, but it is evaluated to determine whether or not it is sufficiently formulated to support expansion prior to any attempt to decompose the subproblem. This latter model suggests that the planner possesses explicit meta-knowledge that supports both the recognition of when a subproblem is sufficiently formulated as well as knowledge about how to specify and solve the metaproblem of developing the information required to obtain a well-formulated subproblem. In this case, the planning bias is less likely to be introduced into the retrieval and inference process that has been initiated. This is simply because the problem of further specifying a subproblem is not initiated by a

specific rule of decomposition, but rather by knowledge that is specified independently from the decomposition rules.

The triggered case is very similar to that used by a least commitment planner such as MOLGEN as developed by Stefik (1980; 1980). However, in this case the data searched is fixed, correct and complete. Consequently the issue of bias does not arise. PLANX-10 (Bresina, 1981; Sridharan, Bresina & Schmidt, 1983 ) was also a planner that possessed powerful abilities to defer commitment and exercise arbitrary control over its order of expansion of subproblems. This planning model also included the ability to draw default inferences when faced with an impasse due to the incompleteness of its knowledge. However, the default inferencing strategy employed was limited and chaining of such inferences was not allowed. This tended to control the degree to which the resulting plan could be biased by the planning process itself as well as to provide the discipline required to simply annotate the ways in which the plan depended upon such default inferences.

In the triggered case the specific metagoal of what information is required to provide a well-formulated subproblem is a result of the specific rule of decomposition that provided the trigger to this metaproblem. In the predictive case, the goal of the metaproblem is not directly dependent upon the chosen rule of decomposition. In problems such as battlefield planning where styles of default reasoning are present, this is an especially important distinction. However, these two cases may be difficult to distinguish empirically in the planning protocol of the experts.

Figure 1 provides a graphical depiction of a "simple" control cycle that could support a step that involves the predictive introduction of the metaproblem of deriving a well-formulated subproblem prior to subproblem expansion. Here, the basic cycle is expressed as metaproblems for the planner. It involves first choosing a subproblem, next providing a formulation of this subproblem if this is required, next decomposing the subproblem; this may be followed by critiquing and posting constraints, which may next lead to a process of local repair, and then the cycle begins again with the now expanded tree. Such a control is basically similar to that described for the planning model that implements a method of least commitment except that the meta-level problem of formulating a subproblem has been added.



**Figure 1. Meta-level Control**

We will use this basic first-order model of the possible control strategy employed by experts in battlefield planning in two ways. First, we use the list of metaproblems: choosing and formulating a subproblem, decomposing the subproblem, critiquing and evaluating the resulting decomposition, and possible repair of the decomposition, to provide a presumably exhaustive taxonomy of possible tasks that the experts might carry out during the planning episode. Consequently, we will attempt to determine whether the protocol provides evidence of the experts engaging in these tasks. Second, this model predicts a particular ordering in which these tasks should be carried out. Again, we can attempt to determine the degree to which the planning protocol provides evidence consistent with this ordering. Finally, the model represents an overall depth-first search strategy where alternatives should be specified quite locally as part of a backtracking strategy.

## METHODS

In the present paper we do not provide a detailed description of the particular type of planning problem this research addresses. That description can be found in Loberg and Powell (1988) which provides a detailed description of the elements of the situation description (enemy and friendly forces, and terrain) and mission description of the corps planning problem. That paper also provides a detailed description of the major plan elements for this planning problem, namely: scheme of maneuver, task organization, task allocation, command and control measures, and support priorities. And that paper presents a description of the doctrinal specification of the military planning process (Figure 2 of the present paper) and discusses what appear to be the key tasks within that process. The emphasis of the present paper is a detailed analysis of the planning activities observed during a planning exercise at the U.S. Army War College (AWC) and how those activities relate to the first-order model of human planning in this domain.

### Simulated Planning Exercise

This section describes a simulated planning exercise conducted at the U. S. AWC at Carlisle Barracks, Pennsylvania (1986). This video-taped exercise provided the operational planning data that we analyzed and will discuss in the RESULTS section. The participants in this exercise were two members of the student body, each of colonel rank and with considerable experience in planning. During the course of the exercise the players assumed the roles of corps commander and corps G3 (operations officer). While the exercise was artificial in that the detailed staff action supporting the planning process was not played, it did address key problem-solving elements of the process and mental processes of these planners as they considered these elements. These elements, or tasks, include the mission analysis, terrain analysis, enemy force analysis, and courses-of-action phases of Figure 2, The Military Planning Process. Figure 2, which was adapted from *FM 101-5 Staff Organization and Operations*, illustrates the major activities of the entire process. The squared rectangles represent staff actions and the rounded rectangles represent commander's decisions. A characteristic of the military planning process clearly reflected by Figure 2 is the significant requirement to develop information both prior to, and interleaved with, course-of-action development.

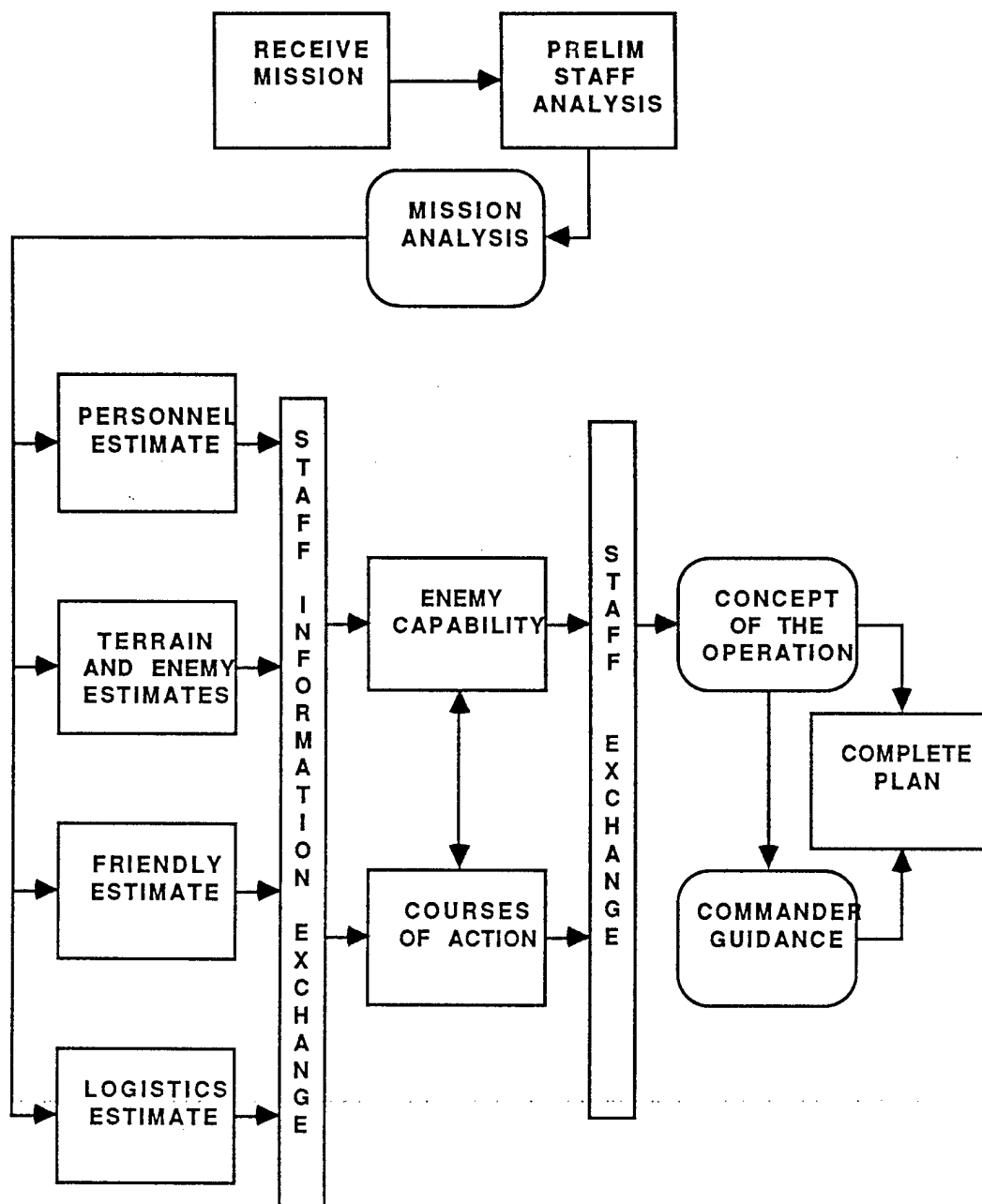


Figure 2. The Military Planning Process

The following description of the exercise commences with a brief overview of the scenario, or the particular planning problem the corps staff must solve. This description is followed by a presentation of our results which includes an analysis of the verbal protocol obtained during the exercise.

### ***Exercise Scenario***

The United States' 11th Corps, with principal subordinate elements including the 4th Armored Division, the 90th Infantry Division (Mechanized), the 80th Infantry Division (Mechanized), and the 14th Armored Cavalry Regiment, has been assigned to the NATO Middle Army Group, or MIDAG. Although hostilities have not yet commenced, it is believed that enemy forces will attack NATO forces across the German border. The MIDAG commander and staff have completed and disseminated the MIDAG operations plan for the forthcoming operation. As a MIDAG subordinate element, the US 11th corps has been assigned a mission and given responsibility for a sector of terrain (see Figure 3) as part of that operations plan.

The MIDAG operations plan describes the operation as follows:

MIDAG prepares to defend in zone with 2nd (BE) Corps, 4th (GE) Corps and 11th (US) Corps defending in sector. On order 2nd (BE) Corps, 4th (GE) Corps and 11th (US) Corps occupy sector and establish covering force along the international border. Upon commencement of Warsaw Pact attack MIDAG defends in zone. MIDAG attacks to destroy enemy forces and secure NATO territory in zone." (*US Corps Operations-Letort 85*)

As part of this operation, the 11th Corps has been assigned the following missions:

- "(1) Defend in sector.
- (2) Attack to secure NATO territory in zone.
- (3) Prepare to continue the attack to destroy Warsaw Pact forces in zone and to secure Magdeburg and a bridgehead over the Elbe river in order to restore access to Berlin." (*US Corps Operations-Letort 85*)

The sector given the 11th Corps (see Figure 3) has a number of prominent terrain features. The Harz Mountains in the southeast are an obstacle to the movement of large, military forces. They can be characterized as rough, forest-covered terrain with limited road networks. The areas around Braunschweig and Hannover are significantly urbanized and present other obstacles to military movement. The areas immediately to the east and west of the Weser River are hilly and provide excellent defensive terrain. Most other terrain in the corps sector provides no significant advantage to either the defender or the attacker.

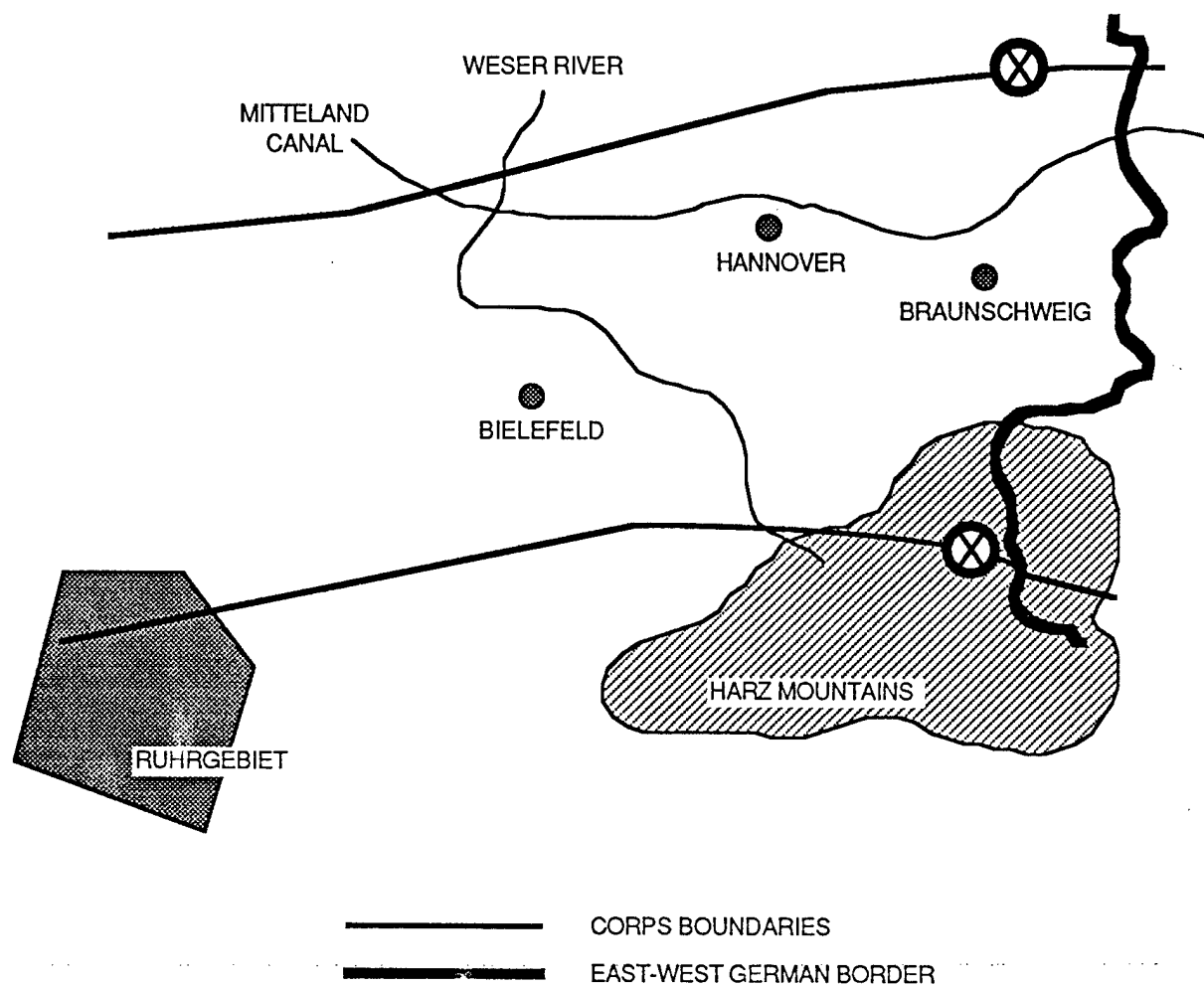


Figure 3. The Scenario

## RESULTS

The results are organized into three major sections. In the first section, we identify three categories into which information characterizing problem states in this type of planning seems to fall. Then we relate this categorization to the model. The categorization is exemplified in the course of presenting a "test" of the descriptive adequacy of the model. This test constitutes the second section and is performed by comparing statements made by the planners, and the ordering of those statements in the protocol, to the types and ordering of operations in the model. In the third section we discuss knowledge classes, the existence of which is implied by the elements of the model.

### Categories of Information

The information defining problem states in this type of planning can be characterized in various ways (e.g., in terms of incompleteness and uncertainty). One way in which to characterize this information, which we think is useful, is in terms of whether it is given to planners in a form directly usable for planning purposes or whether the planners must derive the information they need. For this particular characterization we have identified three categories into which information seems to fall and which we call Given, Retrievable and Must-Derive (see Tables 1 & 2). Some of this information is always given to the planners (Given), other of it is available but usually must be sought by the planners (Retrievable), while still other of it must be developed by the planners (Must Derive). This categorization is exemplified at many locations in the protocol. We identify instances where planners retrieve or must derive information by explicitly stating, in the interpretation of the protocol, that these types of operations occurred. For example, all of the protocol in paragraph A. I<sub>2</sub> & G<sub>2</sub> of US 11 Corps (further specified via derivation) of subsection *Protocol Analysis* represents instances where the planners derived the information they needed. Except where it seems obvious we have included in the interpretation, for each instance of a category, the type of information involved (avenues of approach, implied operational constraint, etc.) as shown in Tables 1 and 2.

The planners' need to derive information will vary depending on such things as the degree to which friendly forces have had the time and intelligence-collection resources to gather and develop it and the degree to which it is specified as part of the operations plan (OPLAN) or order<sup>2</sup>. It should be noted that some information related to the OPLAN may be presented to the corps planners only verbally. In Tables 1 and 2 we have organized the information types (e.g., Maps of region, Enemy force Task Organization) such

that they are associated with descriptions of either the initial state or goal state of subproblems. At present, our understanding is that the initial statement of the problem (i.e.,  $I_0-G_0$ ) will always include the information types shown in category Given, but that the planners' need to retrieve and/or derive information may occur at the time they are given an OPLAN (i.e.,  $I_0-G_0$ ) or at any other point in the planning process. The significant requirement for subproblem formulation in this type of planning is reflected by the types of information in Tables 1 and 2 which typically are not given to the planners, but which must be retrieved or derived by them. Subsection *Protocol Analysis* further reflects this requirement by identifying those statements in the protocol which appear to represent instances of subproblem formulation.

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<u>Given</u>	<u>Retrievable</u>	<u>Must Derive</u>
Maps of region - 1:50,000 - 1:250,000	Terrain factor overlays - roadnets - go/slow-go/no-go ...	Terrain objects - obstacles - avenues of approach - key terrain ...
Terrain Overview - textual description of own area of influence		
Operational overlay providing C2 measures - own sector boundaries - coordinating points (optional) - FEBA <sup>3</sup> (optional) - phase lines (optional)		Operational overlay providing C2 meas. - coordinating pts. - FEBA - phase lines
Enemy force - task organization - overlay - capabilities - intentions	Enemy order of battle (OB)	Enemy force capabilities and intentions [based on assessment made by corps]
Task Organization for - own Army Group - theatre - deploying forces	Friendly OB - status - strength - history ...	Friendly force capabilities
Task Allocation for - own Army Group (AG) - each corps in AG		
Scheme of Maneuver for own Army Group		
Support Priorities for own corps		

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Table 1. Categories of Information for Initial State, I<sub>j</sub>

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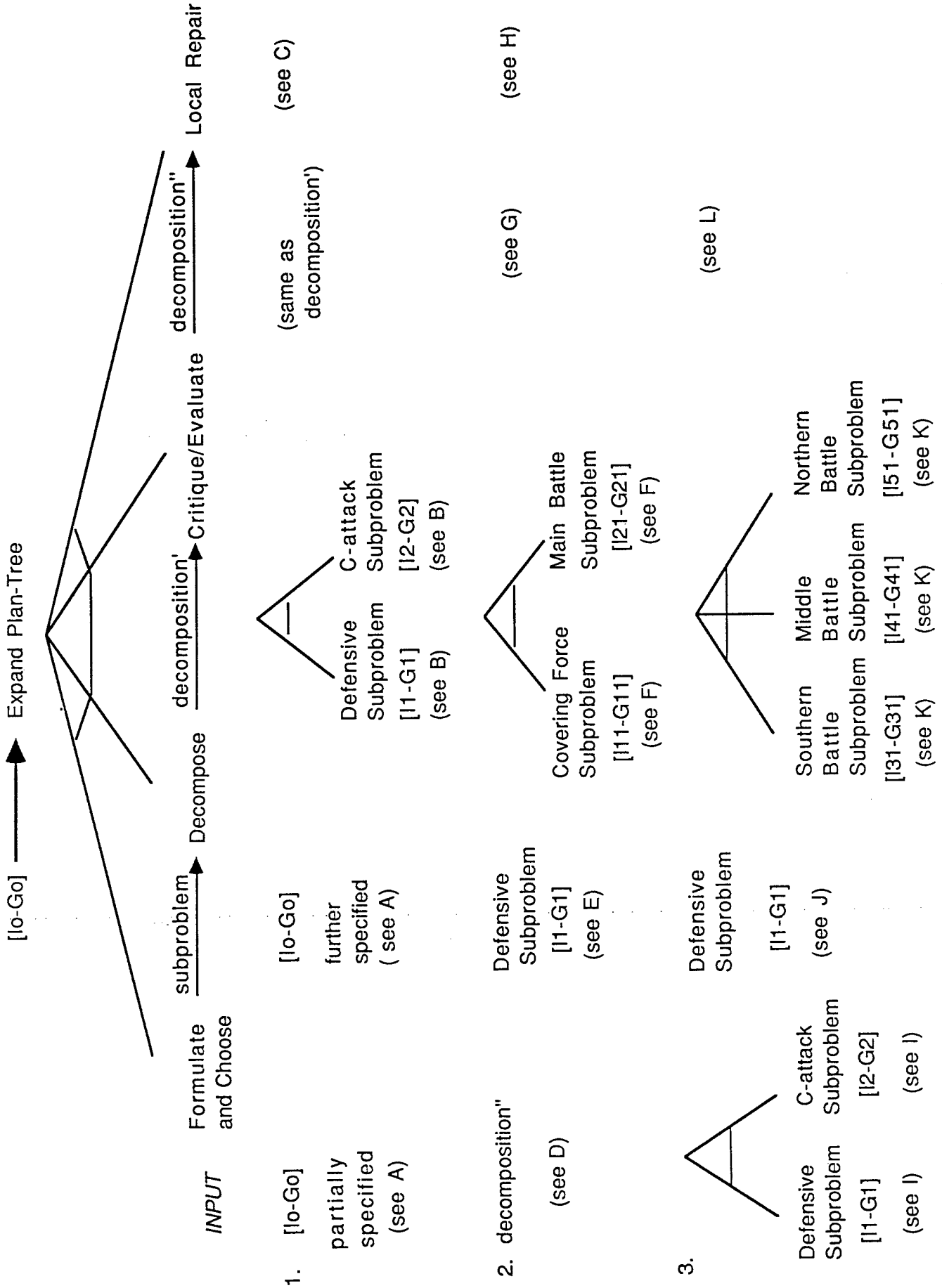
<u>Given</u>	<u>Retrievable</u>	<u>Must Derive</u>
Specified tasks <sup>4</sup>		Implied tasks
Specified constraints		Implied constraints
- temporal		- temporal
- spatial		- spatial
- operational		- operational
Purpose(s) of tasks		Purpose(s) of tasks
- partially specified		- further specified
- incomplete set		- more complete set
Ordering of tasks		Ordering of Tasks
- partially specified		- further specified
Commander's guidance		Commander's intent
- two echelons above		- two echelons above
corps inclusive		corps inclusive

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Table 2. Categories of Information for Goal-State,  $G_j$

### Descriptive Adequacy of the Model

In this section we examine the descriptive adequacy of the model by comparing the planners' statements (and their ordering in the protocol) to the types and ordering of operations shown in Figure 4. Figure 4, which is simply a tree version of Figure 1, has three rows of information numbered 1, 2 and 3. These rows represent the flow of planning specified by the model, namely, from left-to-right and from row-1 to row-n. The characters A through L appearing in each cluster of information, in the three rows in Figure 4, index the particular paragraph (e.g., (see A)) the reader should refer to in subsection *Protocol Analysis* (see below). Each paragraph describes the problem state-pair resulting from the application of a particular operation in the model. For example, the input to the operation *Formulate and Choose* is shown by the column of information under *INPUT* in Figure 4. The first cluster of information serving as input to *Formulate and Choose* cites paragraph A. In general, the paragraph cited on the left-hand side of an operation in Figure 4 describes the problem state-pair serving as input to



the operation and the paragraph cited on the right-hand side of an operation describes the problem state-pair representing the output of the operation. The exception to this scheme of indexing input and output occurs for the operation *Local Repair*. In the case of *Local Repair*, the paragraph cited as its output appears directly beneath *Local Repair* in the figure. Each paragraph also contains statements from the protocol which are presented as evidence for the interpretive statements made about the planning activities observed. The numbers appearing within brackets at the end of each quotation in subsection *Protocol Analysis* represent the line numbers, within the transcript of the protocol, from which the quotation was taken and thus reflect a temporal ordering of the planners' statements as they were made during the planning exercise. The complete transcript to which the model was applied is reproduced in Appendix A.

In its current state, the model represents an initial approximation of human operational planning. The protocol under consideration represents the first data to which the model has been applied for the purpose of testing its descriptive adequacy. These data were collected prior to construction of the model so the test of the model is retrospective.

An examination of the relationship between the operations of the model and the line numbers associated with the lines of the transcript exemplifying the operations indicate there is a strong correspondence between the ordering of operations specified by the model and the ordering of planning activities in the protocol related to those operations.

### ***Protocol Analysis***

This section presents the results of the protocol analysis in the form of descriptions of problem state-pairs (paragraphs A-L) associated with operations in the model. Refer to the first paragraph in *Descriptive Adequacy of the Model* for a description of the relationship between these state-pair descriptions and Figure 4. Comments between { } are our annotations.

#### **A. Io and Go Given to US 11 Corps (partially specified)**

**Io: Provided by terrain map, overlays and OPLAN**

*Terrain , and Command and Control Measures*

- a. Geographic map of region (1:250,000)
- b. Sector of US 11 Corps defined on map via operational overlay

- c. IGB on operational overlay
- d. FEBA on operational overlay
- e. Terrain overview - textual description of US 11 Corps area of interest in West Germany (included with OPLAN from MIDAG)

### *Enemy Forces*

- a. Enemy force Task Organization
- b. Enemy force laydown on overlay (first echelon, division-sized units)
- c. Enemy force intent (given in OPLAN from MIDAG)

### *Friendly Forces*

- a. Task Organization for MIDAG (details only for US 11 Corps, Theatre and Deploying forces; not for adjacent corps)
- b. Support Priorities for US 11 Corps

### Go: Provided by MIDAG commander's concept of the operation and guidance

- a. MIDAG will defend in zone with 2d (BE) Corps, 4th (GE) Corps and 11th (US) Corps defending in sector
- b. Focus on destruction of Warsaw Pact (PACT) military forces
- c. Conduct main defensive effort in northern portion of MIDAG sector
- d. Trade real estate for destruction of PACT military forces
- e. Deploy a strong covering force
- f. Deploy covering force on best defensible terrain nearest the IGB and present PACT with fierce and continuous battle from that border westward
- g. Once border (IGB) is violated, adjust assets to fight close-in fight and deep battle in your area of influence
- h. The direct destruction of combat power should be focused on the close-in fight
- i. Priorities for use of combat power and Intelligence in deep battle are:
  - special weapons' delivery units
  - C2
  - bridges and all other engineering equipment
  - lines of communication and logistics facilities
- j. Try to stop PACT east of Weser in north (and Fulda and Werra in the south)
- k. Must stop PACT between Weser and Rhine (preserve command while inflicting maximum damage)
- l. When MIDAG is able to attack, the intent is for the main attack to be done by the US 11 Corps - plan to cross the Elbe and strike toward Berlin

- m. Must survive PACT's use of nuclear and chemical delivery capabilities
- n. Offensive air support extremely limited during first few days

### lo and Go of US 11 Corps (further specified via derivation)

lo:

- a. Obstacles to enemy force

"This canal here which is as deep as the Mittleland canal. The Weser, the Leine up here {both rivers}, right in here is marshy." [2-3]

- b. Avenues of approach of enemy force

"The real objective however is a deep objective back here across the Leine. Rapidly. They're going to want to bypass Hannover and all this built-up stuff over here [points to left of upper center of map]. If they go north they can't use the autobahn. If the bridges are dropped on the autobahn they've got three river crossings to make, marshy areas here [upper right quadrant of map is pointed to]. I put them down through here [points to the center right]." [12-18]

- c. Location of enemy force main attack

"Yeah and then the main attack will be coming across here [points to right center of map and then across to the left]." [21-22]

- d. Location of enemy force feint of main attack

"[points to the upper right section of the map] Some of these here {enemy units}, perhaps six, will try to make it through to feint an attack." [19-20]

Go:

No further specification was apparent for this problem statement.

### B. Defense-to-the-Rhine [I1-G1] and Counter-attack [I2-G2] Subproblems

The decomposition chosen here is strongly constrained by, and consistent with, the OPLAN given to the planners (i.e., a defense and intent to attack to the east (counter-attack) are stated as requirements in the MIDAG

commander's guidance). However, it is not obvious that this is the only decomposition they might have chosen. For example, it seems plausible that the decomposition may have consisted of, in addition to the counter-attack subproblem, two defensive subproblems in the form of defending from the IGB to the Weser River and defending from the Weser River to the Rhine River.

#### I1:

a. I0 is inherited by, and provides the definition of, I1 except for the geographic region.

b. The geographic region is from the IGB to the Rhine River. The planners use element k. in Go to infer the geographic extent of the defensive plan. See the last two sentences in the quotation given under section G1: b. below. [167-174]

#### G1:

a. Go (except for *element l*) is inherited by G1.

b. The PACT force must be stopped (i.e., defensive battle) before the Rhine River. This is an example of a specified task.

"The boss would like us to hold east of the Weser. He would really like that. He says "I believe we can stop the attacker east of the Weser River, and north of the Fulda River. If we do, it will make it easier for the Middle Army Group to assume the defensive. If we cannot, and here again this is pretty consistent with telling us not to die in place, if we cannot stop the attack then I will need your corps and subordinate commands as healthy as possible in order to stop him between the Weser and the Rhine." So I'm going to have to plan, you know, for a defense from here [points to left upper quadrant of the map] and all the way back to the Rhine which is off the map." [163-174]

#### I2:

a. Using *elements j, k and l from Go*, the planners infer that their counter-attack plan will have a geographic extent from the Rhine River to Berlin with the extent possibly limited to the geography between the Weser River and Berlin.

b. The planners strike a phase line at the Weser River; this is a command and control measure which they inferred from the mission statement and it relates to *element j. in the partial specification of Go* (it reflects a

recognition by the corps planners of at least a first and second phase of the battle).

"What that's done is dictated the first phase line that you put on the map. Near the Weser because you know that there's a phase, at least one phase that's going to happen before that. And at least one phase that's going to happen behind that. And it's a geographically distinctive feature. Therefore you would strike some sort of phase line there." [175-182]

## G2:

a. The planners identify *element 1 from Go* as the definition of G2. They state that they understand the MIDAG commander's intent to be to counter-attack. This is an example of understanding the intent of the commander who is at echelon-above-corps.

"And in the back of my mind I know, see, this is where we said if we understand the commander's intent we can plan a lot smarter because his intent is ultimately for us to counter-attack. Knowing that, it all makes sense. You can't counter-attack with nothing." [204-208]

b. The planners state that they recognize the necessity to be prepared to counter-attack, and that this necessity imposes a constraint on how they can defend. This is an example of an implied operational constraint.

"To a degree it imposes a restriction on how you defend. The restriction being, you've got to keep in the back of your mind a continuous readiness to attack. You cannot attack with forces in contact." [209-212]

c. The planners infer that in order to conduct a counter-attack they will need a force in reserve; a Division-sized force, armored if the terrain is appropriate.

"Which tells you that you gotta keep a reserve. A reserve that has the capability to kick butt. In gross terms what it told me is keep a division in reserve and if the terrain dictates keep an armored division in reserve." [214-217]

d. The planners also stated that an inability to attrit sufficiently with two divisions could result in the armored division not being used as the reserve, i.e., it may need to be committed to the defensive battle.

"Now we may get up here and look at this thing. We've got three divisions. We may not be able to attrit sufficiently with two. Which poses a limit. It could mean we'd take a brigade. It could mean we'd take a brigade plus the cavalry regiment which is the screening force. But it's got implications. Most guys like to keep something in their hip pocket anyhow." [221-227]

### C. Local Repair

A local repair was not required because the planners appeared to find decomposition' (i.e., [I1-G1] and [I2-G2]) satisfactory. They made no comments that would indicate decomposition' required modification.

### D. INPUT

Decomposition", which is the same decomposition mentioned in paragraph C. Local Repair above, provides the input to *Formulate and Choose*.

### E. Defensive Subproblem

The planners chose to work on Defensive Subproblem [I1-G1]. However, additional formulation of this subproblem was not performed. The choice of this subproblem is represented as the output of *Formulate and Choose*.

### F. Covering-Force Subproblem and Main-Battle Subproblem

The planners appeared to decompose Defensive Subproblem into a Covering-Force Subproblem [I11-G11] and a Main-Battle Subproblem [I21-G21].

#### I11:

Information defining state I1 is inherited by I11. That information plus *element f. from Go* is used by the planners to infer that the geographic extent of the Covering-Force Subproblem should be from the IGB to the FEBA.

"He even told us where to establish it {the covering force}. Along here [points to the area along the IGB]." [232-233]

The next quotation actually followed the planners' assignment of a particular force to the covering-force area (see G11 b.). It appears here because it indicates how the planners decided the geographic extent of the covering-force area.

"What you've got to do is subdivide the battlefield into covering-force area and main-battle area {we believe this statement reflects the planners' choice of decomposition of the defensive problem}. You determine the main-battle area based upon the first defensible terrain where you can have a continuous defense established. That becomes, by definition, the FEBA or the main-battle area. By definition, everything to the bad guys' side of that is covering-force area. So, while it might have appeared that we were concentrating on the covering force, the fact is we were drawing the line between the main-battle area and the covering-force area. That's what we just did." [287-296]

#### G11:

a. Information defining state G1 is inherited by G11. *Elements e. and f. of G1* are constraints which specify: the use of a covering force and the location where the covering force should be deployed. These are examples of a specified operational constraint and a specified spatial constraint respectively.

"Well, in fact we were told to {establish a covering force}. It's as cut and dried as that. He even told us where to establish it." [230-232]

b. The planners assign the 14th Armored Cavalry Regiment (14 ACR) to fight the covering-force battle.

"We are trying to envision the way the covering-force battle would go. A cavalry regiment, it's a pretty sizeable outfit. It's got good communications. It covers a lot of ground very quickly not without some punch and it does have an air cavalry squadron. " [264-268]

#### [I21-G21]:

The second quotation under I11 refers to the main-battle subproblem of the defensive-subproblem decomposition. It also refers to the planners' identification of the forward geographic boundary of this subproblem. At this stage the planners did not discuss this subproblem further.

#### G. Critique/Evaluate

Following the decomposition of Defensive Subproblem into a Covering-Force Subproblem and a Main-Battle Subproblem, and the assignment of the 14 ACR to the Covering-Force Subproblem, the planners state that the 14 ACR will need more depth in the southern aspect of the covering-force area to

adequately develop a defense and that more continuity between the US 11 Corps and NORTHAG in the initial defense will be needed in the northern aspect of the covering-force area. So, these two regions of the covering-force area are marked in decomposition" as problems that need to be addressed by *Local Repair*.

" We would like to give them {14 ACR} a little continuity. And in order to do that, we set what we felt was our first really defensible line. We adjusted your FEBA a little bit. That was to give better continuity in the initial defense and to provide a little bit of depth for the cav to develop. Not a lot, but a little bit. Plus if you look at the area to our north where those guys {NORTHAG} would probably establish. See this continuity. A highway's there. The IGB goes back. So those guys up north would probably be defending along here [points to a region within the NORTHAG sector]. So that adjustment, we'd work it out. It's {the degree of adjustment} about the same as the south {adjustment}." [268-279]

#### H. Local Repair

*Local Repair* receives decomposition" as input. Both problem areas marked in decomposition" are repaired by adjusting the FEBA to give more depth in the covering-force area in the south and more continuity with NORTHAG in the initial defense in the north. The quotation in G. Critique/Evaluate above refers to the nature of these repairs. [268-279]

#### I. Alternative Decomposition for Defensive Subproblem

At this point the planners choose an alternative decomposition for the Defensive Subproblem. We represent this state under INPUT in Figure 4 as a return to the original conjunction of [I1-G1] and [I2-G2]. The planners recognized that this alternative decomposition violated the commander's guidance given in the OPLAN and that this decomposition was chosen only for the purpose of showing what these planners would have done if guidance had not constrained planning in the way that it did.

a. It appears that the planners took issue with the MIDAG commander's guidance to establish a covering force when MIDAG was not going to control that force. Although the planners began development of the first scheme of maneuver in accordance with this guidance, their dissatisfaction with this guidance appeared early in the planning session during their reading of the OPLAN.

"I personally, as a corps commander, would be resentful of that to start with." [234-235]

"If he is going to give me {i.e., the superior commander was not retaining control of the covering force} a sector going all the way to the border, then it's none of his business really whether or not I use a cover force." [241-243]

b. The planners' recognize that the alternative decomposition they would give was a violation of guidance.

"What I personally might have opted to do, and he's cut my options (my commander), I might have considered because this is ..." [299-301]

#### J. Defensive Subproblem

The planners choose Defensive Subproblem [I1-G1] to be expanded next. We give this interpretation because the planners began working on this subproblem rather than the counter-attack subproblem.

#### K. Southern-, Middle- and Northern-Battle Subproblems

The planners appeared to decompose Defensive Subproblem [I1-G1] into three subproblems (Southern-Battle, Middle-Battle, and Northern-Battle) each consisting of a geographic region of the US 11 Corps sector originating at the IGB and terminating at the Rhine River.

Initially, the choice for this alternative decomposition seemed to be based on two factors, namely: terrain in the southern aspect of the corps' sector is well-suited for the use of the cavalry regiment; and keeping the battle under the control of a single commander across the entire battlefield.

"... I might have considered because this is pretty damned tough terrain in the southern part of the sector. And because you want to keep the battle under the control of a single commander who can understand what's going on all the way across the battlefield. Particularly when you are waiting for the bad guys to attack you know what they are doing." [301-306]

In a discussion following the planners' presentation of this decomposition of the Defensive Subproblem, they provided additional information regarding its choice.

"Another major factor in that decision process and one that, remember I told you a while ago, that by exploring the whys {i.e., seize initiative to counter-attack} within the original guidance dictates to some degree what your scheme up here is [points to map]. It tells you you want to maintain flexibility. One of the ways you gain flexibility is defending on a narrower sector. A sector narrower in fact than your force can defend {i.e., your force can more easily defend on a narrower sector than a wider sector}. So you take a combination of the terrain in the south, the width of the sector north of that terrain and you cut that in half then what you've given the division commanders is flexibility for them to maintain their own reserve."  
[458-467]

### I31:

a. I1 is inherited by, and partially defines, I31. The planners partitioned the geographic region of the corps sector first by drawing a line from the IGB to the Rhine River in the southern aspect of their sector. This line provides the northern boundary for this subregion of the sector.

"I might have wanted to draw a boundary that went something like this [draws a line on the acetate]." [308-309]

### G31:

The planners assign the 14 ACR to the subregion defined in I31. They indicate the ACR will fight both the covering-force battle and main battle in that subregion.

"Giving the cav regiment an economy-of-force mission in the south, and putting two divisions on line from here north [points to the north of the boundary line he had drawn for the 14 ACR] with each division providing its own cover force." [363-367]

### I41:

I1 is inherited by, and partially defines, I41. The planners decompose the remainder of the corps sector by drawing another line which begins at the IGB and ends at the Rhine River. This line approximately splits this remaining geographic subregion of the corps sector.

"... and we gave that to the regiment and we put another boundary between divisions up here someplace." [386-387]

## G41:

a. The planners assigned one mechanized division (the 90th) to fight both the covering-force battle and main battle in this subregion; they gave the division control of its covering force (see quotation under G31 [364-367]).

This assignment of a single division to fight both these battles seems based on the planners belief that there will be one continuous battle from the IGB to the Weser River (main defense of corps begins at the Weser, i.e., up to this terrain feature the defensive battle will be under the command and control of the corps' subordinate forces; the Weser is the location of the first phase line struck by the planners).

"We're back with the continuity of the battle flow from the border back. Not a strict transition of the battle along here." [389-391]

b. The planners believe a continuous battle should be under the control of one commander.

See second and third sentences in the quotation directly under  
K. Southern-, Middle-, and Northern-Battle Subproblems. [302-306]

c. In Counter-attack Subproblem [I2-G2] the planners inferred that a division-sized force (armored if terrain is appropriate) would be required to conduct the counter-attack. However, they also stated at that time that if they could not develop a sufficient defense with their other forces, then the armored division, or at least part of it, would not be kept as the reserve force (see G2: d.). Although it was implicit from the time they stated that a division (armored if necessary) would be required to conduct the counter-attack, it was not until the planners were asked about the reserve force that we were certain that they had assigned that task to the 4th Armored Division (4AD).

"In fact we have our task organization. ... What we're seeing right now is a mech to the north and a mech to the south and armored in reserve."  
[636-644]

d. The planners assigned the 4 AD to the rear of the corps sector immediately behind the subregion of the 90 Mech Div. The planners placement of the reserve force seemed to be based on their beliefs that: the enemy main attack was expected to occur through that subregion; if a major attack came from the south, the reserve would be in a good location to help

defend against that attack and; if the defense meets the objectives of the OPLAN given to the corps, the reserve will be in a good location to conduct the counter-attack.

"You always look for a place you can put it {the reserve}; a place you can fit. You've got to look at what are all the possibilities of your utilization of it. And then you examine the terrain, the situation, your deployment and the feasibility standpoint of doing all those things and it kind of falls out at you." [652-656]

"We're trying to think like the other guy. We've got fewer obstacles along in here. You've got canals, you've got the crossings, the autobahn crosses it. So we think, we probably will make our run this way [points to an area of the map]." [663-667]

"What if the major attack does come along this way [points to an avenue of approach entering the corps sector on its southern flank]? See, we've got pivot points. We're not stuck. We've got plenty of options. And a good operator does that." [679-680]

"Now, what if everything goes according to plan and we don't get these divisions chopped up and they both can get back here and occupy a coherent defense along the Weser? Then that would leave us again poised to do the third thing we were told to do. To be prepared to go attack Magdeburg." [696-702]

e. The planners were asked which factors were considered in deciding which units {types as opposed to size} would comprise the reserve.

"We chose the reserve based on its punch. There's not much difference between a mechanized infantry division and an armored division except that an armored division has six tank battallions. Whereas a mechanized division has only got five. The mech division is five tank, five mech. The armored division has six tanks and four mech. Which means that you've got more armor punch to go into a deep attack with the armored division. The additional consideration is in the main battle area. There are lots of good places there because of all these marshes and bogs and all that kind of stuff, to put dismounted infantry in those built-up areas and places like that to conduct a good defense. Built-up areas aren't where you want tanks. So you've got more infantrymen up there in those two mech divisions than you have in the armored division." [727-740]

"There is one intangible. And this goes right back to something else we told you. We like to keep armor in reserve because of the different mentality within the armored division's tactical operation center. If these three divisions knew what the corps order was, before we ever even came and saw them they would probably already have themselves in place. Because armored divisions are used to being employed in a decisive manner and a reserve is the decisive factor." [741-748]

#### **I51:**

I1 is inherited by, and partially defines, I51. The remaining subregion in the corps sector becomes the geographic area for Northern-Battle.

#### **G51:**

The planners assigned one division (the 80th Mechanized Division in this case) to fight both the covering-force battle and main battle in this subregion; they gave the 80th Mech Division control of its covering force.

See G41 (a. and b.) for the interpretations and quotations related to this problem statement.

#### **L. Critique/Evaluate**

No mention was made of needing to adjust the FEBA or anything else in this decomposition. The assignments of forces (each having its own particular role assigned by the planners) to geographic subregions in this decomposition is believed to represent the core of the solution to the planning problem for the scenario given to the planners.

The planners did mention other factors that they would address in creating a scheme of maneuver if the planning context provided the necessary information and called for such consideration. These factors were the following:

(a) personalities of the supporting commanders

"... the personalities of the supporting commanders. You've got to know that. And there could be overriding considerations that would cause us to designate another guy as the reserve guy."

(b) special forces

"They {the ranger battalion} can be used very, very decisively. ... They could support a counter-attack. They could ... . That's not a major force that we would be playing with as a corps commander."

(c) engineer resources

"Now again if we had a different map based on a very key terrain analysis, we might see this guy up here {Division placed in northern subregion} for whatever reason he might need more engineer resources of a kind. So he could end up with more engineer assets, okay."

(d) support priorities

"This guy {90th Mech Div., i.e., the Division opposing what is believed to be the enemy main attack} would definitely have priority in fires."

***Other key comments***

The planners also mentioned that if a 1:50,000 scale map was available, they might make some minor changes to the terrain regions allocated to the subordinate forces.

"Now, what a 1:50,000 scale map would do for you at this point, now that you've got this basic scheme, is you'd be able to be a little more finite in terms of where those lines go. It may be that when you look at this on a 1 to 50 it may be that the ACR sector might run up here somewhere something like that. You'd just have to look at it where you could see the terrain better. And then you could get even more finite when those guys got on the ground."

The planners also mentioned that the corps planning staff would have important decisions to make regarding the locations of various corps assets.

"Now the other thing that we never got a chance to get into. We touched on it once. Now I, the commander, I feel pretty good about this {scheme of maneuver}. And I'll leave my G3 to fight the battle with the G4 and the COSCOM (Combat Service Support Command) commander and the corps artillery commander. Because everybody and his dog wants real-estate back in here. And the very key thing that the G3 does, and this is the allocation of rearward real estate. If you don't do that right you're going to fix the corps, so that, one, it can't extricate itself ... You really have to balance. ... but it is all driven by the scheme."

When questioned, the planners commented on the apparent quickness with which they assessed the battlefield situation and generated the schemes of maneuver.

"See, we don't know when the attack is coming. And, if it comes tomorrow, based on what we've done in a period of over an hour or whatever, you could call the division commanders in right now. And while they were coming in you could have some ops {operations} guy draw just that {i.e., what was on

the acetate at the end of their problem-solving} on an overlay. And you stand there and just talk the division commanders through it. The way we just did. And they can run away and start doing division plans for it. Now, that's not the end of the process. Now, if the attack isn't coming for another three months, and this continuously gets refined, and it may be, based on the G2's templating and where he puts ... and all that stuff, you might do some adjustments to the FEBA and stuff like that to get stuff outside of artillery range and things like that. It's going to be a continuous refinement. Plus those division commanders now will go out and they will get their brigade commanders in, they'll get their battalion commanders, they'll get their company commanders in and they'll all ... and they'll find things that we didn't find based on our rough map recon. So it's a continuous refinement process."

### **Implied Knowledge Classes**

The elements (operations) of the control structure in Figure 4 imply the existence of certain classes of knowledge. In this section we present our current set of those knowledge classes organized by control-structure element. We describe the function served by each knowledge class and give one or more examples to illustrate each function.

#### *Choose Subproblem*

Class. Knowledge must exist regarding the desired order for expanding the plan tree.

Function. This knowledge will serve to identify subproblems whose solutions are critical to the success of the overall plan and/or subproblems which should be planned for in more detail before other subproblems.

Example. The planners seemed to reserve the armored division for the counter-attack subproblem prior to planning for the defensive subproblem; otherwise, little planning was done for the counter-attack subproblem. A possible explanation for this result is based on our belief that when planning

for a mission of defend and then counter-attack to occur in a world which is strongly characterized by uncertainty and incompleteness, more planning should be done for earlier than later activities because the initial and goal states of later activities typically will be more uncertain than those of earlier activities.

### *Formulate Subproblem*

Class. Knowledge is required to recognize an ill-formulated subproblem.

Function. This knowledge will allow the planner to know that either the subproblem needs to be further formulated via retrieval or derivation of additional information, or it may be more appropriate to choose another subproblem to expand next.

Example. The planners required a more detailed analysis of the terrain before they began generating a scheme of maneuver.

Class. Knowledge is required to convert an ill-formulated subproblem into a well-formulated subproblem.

Function. The knowledge serves to increase a planners confidence in his choice for a decomposition of a problem by allowing him to reduce the uncertainty and/or incompleteness of the problem statement before a choice of decomposition is made.

Example 1. Because the information was not given to them, the planners identified terrain obstacles to the enemy force and the avenues of approach they believed the enemy would use. Identification of these terrain objects was performed prior to generating a scheme of maneuver. This example explicates formulatin of an initial state,  $I_j$ .

Example 2. In analyzing the mission statement and commander's guidance they receive from their superior command, the planners must have the knowledge to understand the commanders' intent. They must understand the relationships between the activities/tasks given (explicitly and implicitly) to the corps and the superiors' concept of the operation. The planners were directed to "trade real estate for destruction of PACT forces (preserve command while inflicting maximum damage)." They understood this statement, within the context of the entire OPLAN, to mean they should conduct a dynamic (rather than static) defense and try to maintain unit integrity in preparation for their counter-attack which would be part of the MIDAG counter-attack. This example explicates formulation of a goal state,  $G_j$ .

Example 3. This example is similar to Example 2 in that it illustrates the requirement for knowledge that allows the planners to understand the relationship between the activities of the corps and the superiors' concept of the operation. Example 2 illustrates how the concept of the operation can restrict *how* the corps can fight (e.g., dynamic defense). We believe the present example illustrates the requirement for knowledge that can relate the superiors' concept of the operation to the tactical requirements on *what* forces the corps can use to execute different portions of the scheme of maneuver. The planners recognize the necessity to be-prepared to counter-attack, and that this necessity imposes a restriction on how they are to defend. The planners said an attack cannot occur with forces in contact so they must create a reserve (an implied operational constraint). The knowledge the planners seemed to apply in this case was as follows: (a) If the intent is to counter-attack after a defense, then prior to constructing a plan for the defensive battle retain an adequate size reserve for the counter-attack. This operation indicates the planners are further formulating the goal state for the counter-attack subproblem by constraining the choice of force to a certain size and (b) Select the reserve type based on counter-attack requirements (e.g., deep-strike capability) and terrain types in defensive and offensive battle areas.

#### *Decompose Subproblem*

Class. Knowledge is required to recognize distinct general tactical courses of action, distinct phases of the battle, and geographic locations reflecting points at which critical decisions will be required.

Function. This knowledge is necessary to identify and clarify the types of plans required (e.g., defensive and counter-attack), their spatial extent, and temporal relationships to each other.

Example. The planners decomposed the problem into a defensive subproblem and a counter-attack subproblem. Geographically, they decomposed the defensive subproblem into two areas, namely, that area between the IGB and the Weser River (which they said was one phase of the battle) and that area between the Weser and Rhine rivers (which they said was another phase of the battle). They also identified an area to the east of the Weser River which they said they would use as a point to assess the flow of the defensive battle and to make a critical decision regarding how to adjust the forces.

Class. Tactical knowledge of the relationships between roles, force types, configurations and terrain types is required.

Function. This knowledge is used to assign roles to forces, and to assign those forces in appropriate configurations to geographic areas to solve a subproblem.

Example. Having understood the commanders' intent, the planners had to decide which forces should be placed on which geographic areas in order to provide a dynamic defense which would solve the defense subproblem. The second scheme of maneuver along with the assignments of particular forces to particular geographic areas represents the application of such knowledge.

### *Critique/Evaluate*

Class. Knowledge is required to do critiquing and evaluation of the plan tree.

Function. This knowledge serves to detect and describe conflicts in a decomposition and opportunities for improving adequate decompositions.

Example. The planners detected that the covering-force area in the southern aspect of the corps' sector was too shallow to adequately develop a covering-force defense in depth in that area.

### *Local Repair*

Class. Knowledge is required to resolve detected conflicts, or make improvements to adequate decompositions, in a plan subtree.

Function. In addition to resolving detected conflicts and improving adequate solutions, this knowledge should alert the meta-planner when detected conflicts cannot be resolved. This knowledge should make it possible to express the basis of the failed repair.

Example. The planners resolved the problem of an inadequate covering-force area in the southern aspect of the corps' sector by moving the FEBA farther west in that area.

## **CONCLUSIONS**

The most striking aspect of the protocol for this corps planning problem is the interleaving of the task of subproblem formulation with the tasks of subproblem decomposition, plan critiquing and plan repair. Further, the evidence from the protocol is quite consistent with the ordering of these tasks as predicted from our first-order model. Also of note is the fact that the experts developed, at most, two alternative plans.

The second plan generated by the planners was a revision of the first. The second plan was the result of backtracking to a location in the plan tree where all of the planning results (including problem formulation) to that

point in the first plan were retained in the second plan. For the second plan, the planners retained the first plan through the point where they had decomposed the problem into the defensive and counter-attack subproblems. The plan tree was expanded from that location to complete the second plan. Thus, the planning observed supports an overall depth-first search strategy (and associated local plan repair). It should be noted that the first plan they began to construct was constrained by guidance, in the OPLAN they were given, in such a way that they generated a partial plan which was different from what they would have produced if guidance had not constrained them in the way that it did (the second plan they generated was recognized by the planners as a violation of guidance, but produced for purposes of the exercise).

Another characteristic of the planning process was that it was done in a temporally forward direction with respect to the ordering of battle types faced by the corps. The planners appeared to impose one constraint on the counter-attack subproblem very early in planning, but otherwise they planned for the defensive subproblem first. It may be that an offensive mission would show more backward reasoning related to less uncertainty about the initial and goal states.

### **Knowledge Acquisition and Planning Aids**

The interleaving of subproblem formulation with planning tasks is of considerable significance for projected work in knowledge acquisition and the development of planning aids in this domain. First, with respect to knowledge acquisition, this suggests that attention must be given to identifying the knowledge and expertise required to recognize ill-formulated subproblems and the knowledge required to develop the information needed to transform an ill-formulated subproblem into a well-formulated one<sup>5</sup>.

Large institutionally created and supported databases are crucially involved in this task of subproblem formulation. In some cases, the information required by the planners is directly available in the database and support could be realized through provision of a fairly standard query language. However, in other cases the information required to support planning must be derived through inference. Further, in some cases, the inference process may involve the use of default assumptions. Here the ability to provide computational aids in carrying out the inference, as well as in annotating the structure of the inference process, might be of considerable importance.

One type of computational aid that may be of importance in this type of planning is external memory. The vast quantity of information to consider in

this type of planning and the apparent complexity of the structure of this type of plan suggests that the inferencing necessary to generate plans and the subsequent evaluation, maintenance, and revision of plans are hindered by human memory limitations. External memory to facilitate the storage and retrieval of necessary information, related to situations and plans, should allow planners to have a style of planning less hampered by human memory limitations. For example, an external memory facilitating the recording and retrieval of assumptions and decisions made as part of the planning process should increase the planners' capability to simultaneously consider multiple plans.

Also, we think it is appropriate to view this type of planning as cooperative problem-solving. There appears to be much knowledge that needs to be shared and understood by multiple problem-solvers to support the development of coherent plans. For example, we observed that the planners' communications largely were with respect to information provided by, or that they recorded on, the map and acetate. Here again we see a potentially important role for external memories in this type of planning.

### Notes

1. The value of the subscript indicates a particular decomposition.
2. An operations order is an order issued by a commander specifying missions and tasks to be accomplished by his subordinate units. The order normally specifies a time at which the operation is to commence, and, unless superseded by a later order, subordinates are to take all necessary action to begin execution at that time. An operations plan is prepared to be executed at some future time, normally unspecified. Operations plans are normally prepared in advanced for certain contingencies, and are executed upon order of the commander.
3. The FEBA is the Forward Edge of the Battle Area, a control measure that identifies where the beginning of the main battle area for the operation will be. Forces within the main battle area defend, attempting to deny success to the enemy forces. Forces forward of the main battle area, the covering force in a defense, attempt to delay the enemy as it approaches the FEBA, disrupting and confusing his approach.
4. In mission analysis (*FM 101-5 Staff Organization and Operaitons*) the planners must identify specified and implied tasks. By task we mean subgoal rather than subproblem because it appears that specified tasks are more like statements of objectives than statements of problems.
5. Another area where there may be implications for knowledge acquisition and development of planning aids involves understanding the extent practice differs from pedagogy in this type of planning. Some of the questions for which answers should be sought are as follows: Do planners use their own procedures or those taught in the schools? In what way are principles of war and key concepts of operational design used by planners (e.g., in plan generation, plan evaluation, or solution explanation)? How explicit is the use of such principles and concepts?

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## Appendix A

\*A and \*B = planners

\*C and \*D = interviewers

001 \*A NOT MAJOR THINGS, BUT A WHOLE LOT OF GARBAGE... [POINTS TO  
002 THE LEFT OF THE CHART] THIS CANAL HERE WHICH IS AS DEEP AS THE  
003 MITTLELAND CANAL. THE WESER WHICH IS... THE LEINE UP HERE AND  
004 THE OPEN... RIGHT IN HERE IS MARSHY [\*A POINTING TO THE CENTER  
005 OF THE THREE PATHS] ... [SPEAKING IN LOW VOICES,  
006 INDISTINGUISHABLE]

007 \*B THE IMMEDIATE FORCES FACING US ARE ALL ARMoured?

008 \*A YEAH

009 \*B HEAVY TANKS?  
010 [MORE INDISTINGUISHABLE MURMERING \*A POINTING TO TOP RIGHT  
011 QUADRANT OF THE MAP USING MARKER TO SHOW FLOW OF BLUE AREA]

012 \*B THE REAL OBJECTIVE HOWEVER IS A DEEP OBJECTIVE BACK HERE  
013 ACROSS THE LEINE. RAPIDLY. THEY'RE GONNA WANT TO BYPASS HANNOVER  
014 AND ALL THIS BUILT UP STUFF OVER HERE. [POINTS TO THE LEFT OF  
015 THE UPPER CENTER]. ...IF THEY GO NORTH THEY CAN'T USE THE  
016 AUTOBAHN. IF THE BRIDGES ARE DROPPED ON THE AUTOBAHN THEY'VE GOT  
017 THREE RIVER CROSSINGS TO MAKE... MARSHY AREAS HERE [UPPER RIGHT  
018 QUADRANT]... I PUT EM DOWN THROUGH HERE [POINTS TO CENTER RIGHT].

019 \*A [POINTS TO UPPER RIGHT] SOME OF THESE HERE, PERHAPS SIX, WILL  
020 TRY TO MAKE IT THROUGH TO FEINT AN ATTACK.

021 \*B YEAH AND THEN THE MAIN ATTACK WILL BE COMING ACROSS HERE  
022 [POINTS TO RIGHT CENTER AND THEN ACROSS TO LEFT]

023 \*A WANT ME TO DRAW SOME ARROWS?

024 \*B YEAH

025 \*B THE FIRST CONSTRAINT IS WORKING WITH THIS SCALE MAP.

026 \*B NEVER PLAN ON A 1 TO 250,000 SCALE.

027 \*A [TURNS AROUND AND FACES CAMERA] THE OLD STORY; LITTLE THINGS MEAN  
028 A LOT.

029 \*B THE IDEAL IN MY VIEW IS 1 TO 100. IT GIVES YOU A LEVEL OF  
030 RESOLUTION THAT IS MUCH BETTER THAN THIS. [\*A AND \*B LOOK AT MAP]

031 \*C WOULD YOU NORMALLY HAVE A SERIES OF TERRAIN OVERLAYS AVAILABLE  
032 THAT YOU WOULD USE IN DOING THIS.

033 \*B YEAH, G2 WOULD NORMALLY WORK ONE, BUT AT THE POINT WE'RE AT  
034 RIGHT NOW IN THE PLANNING HAVING JUST RECEIVED THIS ORDER THEY

035 MAY OR MAY NOT HAVE. IF THIS IS 11TH CORPS' LONG TRADITIONAL GDP  
036 SECTOR; YEAH YOU WOULD HAVE ALL OF THAT. BUT AS I HAVE READ THE  
037 SITUATION THAT HAS BEEN PRESENTED HERE, THAT'S NOT THE CASE.

038 \*A THAT'S RIGHT SIR. [\*A LOOKING AT \*B. THEN \*A LOOKING AT  
039 CAMERA] IN TERMS OF WHAT WE'LL PROBABLY DO, THIS BEING THE TOP,  
040 WE'LL PROBABLY AMBLE OVER TO THE MAP, AND MAYBE TAKE A LOOK AT  
WHERE  
041 THAT WESER IS, GET A LOOK AT THE MAJOR LANDMARKS, GET YOURSELF  
042 ORIENTED, YOU KNOW, ON THE MAP. YOU KNOW, WHAT HAVE I GOT TO  
043 OPERATE WITH. THAT'S ALL WE ARE DOING HERE. WHAT DOES IT LOOK  
044 LIKE.

045 \*B WHAT I GENERALLY DO WHEN YOU GET ONE LIKE THAT IS SIT  
046 THERE AND LOOK AT THE MAP, WHAT YOU ARE TRYING TO DO IS GET A  
047 FEEL FOR HOW THE TERRAIN LAYS AND HOW IT ALL FITS TOGETHER, AND  
048 THINGS JUST KIND OF START POPPING OUT AS YOU LOOK AT THE MAP.  
049 BUT YOU CAN'T DO IT AT THIS SCALE. YOU CAN'T. IT TAKES A LOT  
050 LONGER AND YOU DON'T GET THE LEVEL OF RESOLUTION THAT YOU NEED.  
051 I'D PROBABLY BE SATISFIED WITH THAT MAP ONLY SO LONG AS IT TOOK  
052 MY STAFF TO ASSEMBLE A 1 TO 50,000.

053 \*C SO TH ETING THAT HAS POPPED OUT IN THIS SITUATION IS THE  
054 EXTENSIVE WATERWAYS?

055 \*B [POINTING TO RIGHT EDGE OF MAP] YOU START OFF AND YOU LOOK  
056 OUT HERE AND WHAT YOU SEE ARE TANK FORCES. OKAY? WHAT DO TANK  
057 FORCES NEED TO ATTACK? THEY NEED GOOD TERRAIN [POINTING TO THE  
058 LEFT] WATER IS A MAJOR OBSTACLE. ONE THING THAT JUST JUMPS OUT  
059 AT YOU AS YOU LOOK AT THAT AREA IS THE AMOUNT OF BLUE. ALL THE  
060 RIVERS AND CANALS AND MARSHY AREAS AND ALL THAT STUFF. SO WHEN  
061 YOU TAKE THOSE TWO FACTS AND PUT THEM TOGETHER YOU LOOK FOR  
062 AVENUES THAT DON'T HAVE THOSE THINGS. \*A PLUS HAVE ROADS THAT  
063 NATURALLY FLOW. \*B TRY TO PROJECT YOURSELF INTO THE HEAD OF THE  
064 BAD GUY, COMMANDER. IF I WAS HIM, WHAT WOULD I DO? THAT'S THE  
065 PROCESS WE WENT THROUGH TO COME UP WITH THOSE THREE MAJOR ACCESSES.  
066 WE'RE WORKING GROSS ESTIMATES AT THIS POINT, IF YOU WILL, MACRO-  
067 ESTIMATES. WE AIN'T WORRIED ABOUT REGIMENTAL LEVEL AVENUES OF  
068 APPROACH AND THAT KIND OF STUFF.  
069 BUT JUST A QUICK LOOK AT THAT  
070 TERRAIN. WHAT IT TELLS ME IS DESPITE THE FACT THAT THE MIDDLE  
071 ARMY COMMANDER SAID THAT THE MAIN ATTACK WAS COMING FROM THE  
072 NORTH, I REJECT THAT. I MEAN THE MAIN ATTACK FROM THE NORTHERN  
073 PART OF THE 11TH CORPS SECTOR, AND THE REASON I REJECT THAT IS I  
074 GOT MYSELF IN THE HEAD OF THE OPPOSING ARMOUR HEAVY FORCE  
075 COMMANDER. HE LOOKS AT THIS TERRAIN [POINTS TO THE RIGHT CORNER  
076 OF THE MAP] THE HIGH SPEED AVENUE THAT COULD GET YOU IN THERE  
077 QUICKEST IS THE AUTOBAHN. BUT, YOU SAY TO YOURSELF, YEAH BUT HE'S  
078 GOING TO DROP ALL THE BRIDGES ON THE AUTOBAHN SO YOU'VE GOT TO  
079 WORST CASE IT AND GOTTA ASSUME YOU AIN'T GONNA BE ABLE TO USE IT.  
080 THIS DOESN'T MEAN YOU'RE NOT GOING TO PUT FORCES ON IT AND TRY TO USE IT  
081 JUST IN CASE HE SCREWS UP. BUT THE SMART OPPOSING COMMANDER IS  
082 GOING TO DROP ALL THE BRIDGES AND YOU WON'T BE ABLE TO USE IT.  
083 WHAT WOULD THAT LEAVE YOU WITH THE NORTH. IT WOULD LEAVE YOU GOING

THROUGH LOTS OF BLUE. YOU'VE GOT TO  
 084 MAKE THREE RIVER CROSSINGS IN THE NORTH, ONE OF WHICH IS A MAJOR  
 085 CANAL, WHICH IS DIFFICULT AND REQUIRES ASSETS TO THESE  
 086 DIVISIONS TO DO THAT WITH. HERE, IF YOU'RE SUCCESSFUL IN GETTING  
 087 ACROSS THESE THREE MAJOR WATER OBSTACLES [POINTS TO THE TOP  
 088 CENTER OF THE MAP] THIS WILL DUMP YOU INTO THE MIDDLE OF DOWNTOWN  
 089 HANOVER. IF YOUR OBJECTIVE IS TO MAKE A DEEP ATTACK AND SEIZE  
 090 CROSSINGS OVER THE RHEINE [POINTS TO THE LEFT OF THE MAP] YOU  
 091 DON'T WANT TO SCREW AROUND FIGHTING THROUGH THE BUILT UP AREA  
 092 AROUND HANOVER AND EVEN IF HE GETS THROUGH HANOVER, WHAT HAS HE  
 093 GOT? HE'S GOT A BUNCH OF BLUE AGAIN. ONE OF WHICH RUNS RIGHT  
 094 DOWN THE CENTER OF THE SECTOR AND KIND OF PINCHES HIM OUT HERE  
 095 [POINTS TO TOP LEFT QUADRANT] SO HE'S GOT MORE RIVER CROSSINGS.  
 096 MORE BUILT UP AREAS, WUNSDORF AND OUT HERE AT MINDEN HE'S GOTTA  
 097 GO THROUGH. THAT'S WHY I PERSONALLY REJECT THE IDEA OF HIS  
 098 MAKING HIS MAIN EFFORT FROM THE NORTH. THEN YOU LOOK FOR  
 099 ANYTHING ELSE THAT CAN INFLUENCE YOUR AREA AND THIS IS A NATURAL  
 100 RIGHT HERE [POINTS TO LOWER RIGHT QUADRANT OF MAP, CURVES TOWARDS  
 101 THE CENTER]. A NATURAL HIGH SPEED, DIVISION PLUS, AVENUE OF  
 102 APPROACH. IT COMES UP OUT OF THE 2ND BELGIUM CORP SECTOR AND IF YOU  
 103 FOLLOW THE NATURAL FLOW OF THAT AVENUE OF APPROACH IT DOESN'T GO  
 104 DOWN THROUGH THE BELGIUM SECTOR BECAUSE OF THE TERRAIN. YOU'VE  
 105 GOT A MAJOR RIDGE LINE THAT COMES THROUGH HERE [POINTS TO CENTER  
 106 OF LOWER LEFT QUADRANT], YOU'VE GOT RIVER CROSSINGS THAT YOU'VE  
 107 GOTTA MAKE, YOU'VE GOT A BIG ESCARPMENT DOWN HERE [POINTS TO  
 108 LOWER LEFT QUADRANT]. THE NATURAL FLOW OF THAT USING THE NORMAL  
 109 ROUTES THAT ARE THERE [POINTS TO CENTER OF LOWER RIGHT QUADRANT,  
 110 CURVING UPWARD WITH TWO FINGERS] IS RIGHT UP IN TO HERE [POINTS  
 111 TO CENTER OF MAP]. INTO OUR CORPS. WELL, THAT'S A MAJOR  
 112 CONSIDERATION HERE. THAT TELLS ME THAT THE MAJOR ATTACK, BY THE  
 113 BAD GUY, OUGHT TO BE THROUGH HERE [POINTS TO CENTER RIGHT OF MAP]  
 114 BECAUSE THE TERRAIN IS MORE TRACTABLE; IT'S MORE CONDUCTIVE TO  
 115 MOVEMENT BY TANK FORCES. YOU STILL HAVE SOME RIVER CROSSINGS  
 116 YOU'VE GOT TO MAKE BUT YOU STILL HAVE MORE OPTIONS BY PUTTING  
 117 YOUR MAIN EFFORT DOWN HERE [POINTS TO CENTER RIGHT OF MAP] THAN  
 118 YOU HAVE IF YOU PUT IT UP HERE [POINTS TO RIGHT UPPER QUADRANT].  
 119 NOW TO FACILITATE MY USING THIS AS MY MAIN ACCESS IF I'M THE BAD  
 120 GUY, I MAY TRY TO MAKE THE BLUE GUY THINK THAT MY MAIN ATTACK IS  
 121 IN THE NORTH AND GET HIM TO TRY TO DEFEND HEAVILY UP HERE. SO HE  
 122 MAY CONSIDER ATTACKING THAT. NOW WHAT DOES THAT TELL YOU FROM  
 123 THE BLUE GUYS SIDE, IN TERMS OF YOUR THINKING? THAT IF YOU SEE  
 124 SOMETHING UP HERE DON'T AUTOMATICALLY ASSUME THAT IT'S THE MAIN  
 125 ATTACK. THAT'S WHAT YOU'LL TELL ME.

126 \*A OK. NOW THE OTHER THINGS THAT WE WOULD, NOW THIS IS ALL GOING  
 127 ON CONCURRENTLY, OK? WE'VE LOOKED AT THIS. WE KNOW ESSENTIALLY  
 128 THAT WHAT HE'S SAYING IS, AND IT'S IMPORTANT THAT WE KNOW THE  
 129 LEVEL ABOVE US, THAT SINCE THIS IS A MAJOR THREAT, UH, LETS SEE NOW,  
 130 LET ME BACK UP HERE SO I CAN BE SURE... [READING FROM DOCUMENT]  
 131 SO THE CONCEPT CALLS FOR HALTING AND DESTROYING PACT FORCES  
 132 ATTACKING NORTH AND MIDDLE ARMY GROUP WHILE ....[STARTS  
 133 TALKING VERY FAST, NOT INTELLIGIBLE, STOPS READING FROM DOCUMENT  
 134 AND POINTS TO LEFT UPPER QUADRANT OF MAP]... ANYHOW WE'VE  
 135 CONDUCTED DEFENSE IN DEPTH UP HERE. OH, AND, WHAT CINCENT WANTS

136 TO DO IN THE SOUTH IS CONDUCT HIS MAJOR ATTACK. SO WE KNOW THE  
137 BOSS, HE'S TOLD US, OK NOW TO FACILITATE THAT, GUYS, I WANT YOU  
138 TO DEFEND IN ZONES FORWARD OF A CERTAIN LINE, BUT, AND HE  
139 UNDERLINES, AND HE TELLS ME TWO THINGS. A LITTLE BIT  
140 CONTRADICTORY. HE SAID, "ORIENT ON THE DESTRUCTION OF HIS  
141 FORCES, BUT, AND HE UNDERLINES THAT, AND IN ANY CASE YOU MUST  
142 PRESERVE YOUR COMMAND WHILE INFLECTING MAXIMUM DAMAGE ON THE  
143 ATTACKER, AND WHAT HE WANTS TO DO OBVIOUSLY IS HAVE ENOUGH LEFT  
144 AFTER OUR DEFENSE TO COUNTER-ATTACK. TO SEIZE MAGDEBURG WHICH IS  
145 UP HERE [POINTS TO TOP RIGHT QUADRANT OF MAP]. IN TERMS OF WHAT  
146 HE DID THAT'S PRETTY GOOD. I MEAN I'M CLEAR. HIS CONCEPT IS  
147 CLEAR. HIS INTENT IS CLEAR. THIS COULD START TELLING ME A FEW  
148 THINGS IN TERMS OF HOW TO ORGANIZE A DEFENSE. I MEAN I'M NOT  
149 GOING TO DIE IN PLACE. HE DOESN'T WANT ME TO DO THAT. MAX  
150 CASUALTIES, BUT DON'T LOSE YOUR COMMAND WHILE DOING IT; MAINTAIN  
151 ENOUGH. AND THEN ONE THING HE DIRECTS; HE DIRECTS THAT WE  
152 ESTABLISH A COVER FORCE.

153 \*B NOW I DON'T UNDERSTAND THAT. THAT WOULD NOT NORMALLY BE A  
154 THING TO COME OUT OF THAT LEVEL OF COMMAND. HE GIVES YOU A PIECE  
155 OF DIRT AND LETS YOU DECIDE HOW TO DO THAT. I DON'T KNOW WHO'S  
156 GOT THIS COVER FORCE IDEA.  
157 {DELETED}  
158 \*C MAYBE WE'VE MADE TOO MANY TRIPS TO THE WAR COLLEGE. MAYBE  
159 WE'RE CONTAMINATED.

160 \*B YEAH. IT MAY BE THAT I'LL WANT TO ESTABLISH A COVER FORCE,  
161 BUT AT THAT LEVEL OF COMMAND YOU WOULD NOT NORMALLY DIRECT A  
162 COVER FORCE.

163 \*A THE BOSS WOULD LIKE US TO HOLD EAST OF WESER [RIVER JUST  
164 WEST OF HANOVER]. HE WOULD REALLY LIKE THAT. HE SAYS "I BELIEVE  
165 WE CAN STOP THE ATTACKER EAST OF THE WESER RIVER, AND NORTH OF  
166 THE FULDA RIVER. IF WE DO, IT WILL MAKE IT EASIER FOR THE MIDDLE  
167 ARMY GROUP TO ASSUME THE DEFENSIVE. IF WE CANNOT, AND HERE AGAIN  
168 THIS IS PRETTY CONSISTENT WITH TELLING US NOT TO DIE IN PLACE, IF  
169 WE CANNOT STOP THE ATTACK THEN I WILL NEED YOUR CORPS AND SUBORDINATE  
170 COMMANDS AS QUICKLY AS POSSIBLE IN ORDER TO STOP HIM BETWEEN  
171 THE WESER AND THE RHEINE. SO, I'M GOING TO HAVE TO PLAN, YOU  
172 KNOW, FOR A DEFENSE FROM HERE [POINTS TO LEFT UPPER QUADRANT OF  
173 MAP WEST OF HANOVER] AND ALL THE WAY BACK TO THE RHEINE WHICH IS  
174 OFF THE MAP. IT'S ABOUT A HUNDRED CLICKS.

175 \*B WHAT THAT'S DONE IS DICTATED THE FIRST PHASE LINE THAT YOU  
176 PUT ON THE MAP.

177 \*C NEAR THE WESER RIVER?

178 \*B YES. BECAUSE YOU KNOW THAT THERE'S A PHASE, AT LEAST ONE  
179 PHASE, THAT'S GOING TO HAPPEN BEFORE THAT. AND AT LEAST ONE  
180 PHASE THAT'S GOING TO HAPPEN BEHIND THAT. AND IT'S A  
181 GEOGRAPHICAL DISTINCTIVE FEATURE. THEREFORE YOU WOULD STRIKE  
182 SOME SORT OF PHASE LINE THERE.

183 \*A SO, WHAT HE AND I ARE GOING TO PRETTY WELL HAVE TO FIGURE  
184 OUT NOW IS WE'RE GOING TO START LOOKING AT WHAT... AND WHO WE...  
185 {DELETED}.

186 \*B WHERE YOU'RE GOING TO MAKE YOUR FIRST LINE OF EFFORT AT.

187 \*A SO NOW WE'RE GOING TO START DOING THAT [\*A AND \*B TURN TOWARD  
188 MAP].

189 \*C OK SIR, LET ME ASK A COUPLE OF QUESTIONS. DID YOU DETERMINE TO  
190 YOUR SATISFACTION WHAT YOUR HIGHER COMMANDER'S INTENT IS AT THIS?

191 \*A YES. WE BELIEVE HE DID A PRETTY GOOD JOB IN TELLING US WHAT  
192 HE INTENDED TO DO. IT'S VERY CLEAR TO US.

193 \*C YES SIR. AND WHAT WERE THE IMMEDIATE, JUST A REHASH OF, THE  
194 IMMEDIATE IMPLICATIONS THAT CAME ACROSS YOUR MIND IN DETERMINING  
195 THE COMMANDER'S INTENT?

196 \*A THE IMMEDIATE TWO THINGS. ONE IS THE ENEMY IN  
197 SECTOR.

198 \*B YOU'VE GOT NO REQUIREMENT TO CONDUCT A STATIC DEFENSE,  
198 NUMBER 1.

200 \*A AND DON'T LOSE OUR FORCES WHILE DOING THAT. THOSE ARE THE  
201 TWO BIGGIES IN MY MIND.

202 \*B FOCUS ON DESTROYING ENEMY FORCES AND AT THE SAME TIME ON  
203 PRESERVING YOUR OWN FORCES.

204 \*A AND IN THE BACK OF MY MIND I KNOW, SEE, THIS IS WHERE WE SAID  
205 IF WE UNDERSTAND THE COMMANDER'S INTENT WE CAN PLAN A LOT SMARTER  
206 BECAUSE HIS INTENT IS ULTIMATELY FOR US TO COUNTERATTACK.  
207 KNOWING THAT, IT ALL MAKES SENSE. YOU CAN'T COUNTERATTACK WITH  
208 NOTHING.

209 \*B TO A DEGREE IT IMPOSES A RESTRICTION ON HOW YOU DEFEND. THE  
210 RESTRICTION BEING, YOU'VE GOT TO KEEP IN THE BACK OF YOUR MIND A  
211 CONTINUOUS READINESS TO ATTACK. YOU CANNOT ATTACK WITH FORCES IN  
212 CONTACT.

213 \*C SO THAT MEANS...?

214 \*B WHICH TELLS YOU THAT YOU GOTTA KEEP A RESERVE. A RESERVE,  
215 THAT HAS THE CAPABILITY TO KICK BUTT. IN GROSS TERMS WHAT IT TOLD  
216 ME IS KEEP A DIVISION IN RESERVE AND IF THE TERRAIN DICTATES  
217 KEEP AN ARMoured DIVISION IN RESERVE. THAT'S WHAT IS TOLD ME.

218 \*C WOULD YOU AGREE WITH THAT SIR? [\*A]

219 \*A YES. BECAUSE YOU SEE....

220 \*B [INTERRUPTS] UNLESS THE TERRAIN DICTATES DIFFERENTLY.

221 \*A NOW WE MAY GET UP HERE AND LOOK AT THIS THING. WE'VE GOT  
222 THREE DIVISIONS. WE MAY NOT BE ABLE TO ATTRIT SUFFICIENTLY WITH  
223 TWO. WHICH POSES A LIMIT. IT COULD MEAN WE'D TAKE A BRIGADE.  
224 IT COULD MEAN WE'D TAKE A BRIGADE PLUS THE CAV. REGIMENT WHICH  
225 WILL BE THE SCREENING FORCE. IT COULD MEAN... BUT IT'S GOT  
226 IMPLICATIONS. MOST GUYS LIKE TO KEEP SOMETHING IN THEIR HIP  
227 POCKET ANYHOW.

228 \*C YOU ALSO EXTRACTED THE NECESSITY TO ESTABLISH A COVERING FORCE  
229 AS WELL?

230 \*B WELL, IN FACT WE WERE TOLD TO. IT'S AS CUT AND DRIED AS  
231 THAT.

232 \*A HE EVEN TOLD US WHERE TO ESTABLISH IT. ALONG HERE [POINTS TO  
233 RIGHT UPPER QUADRANT OF MAP] ALONG THE IGB.

234 \*B I PERSONALLY AS A COMMANDER WOULD BE RESENTFUL OF THAT TO  
235 START WITH.

236 \*C IS THAT AS A CORPS COMMANDER, SIR?

237 \*B YES.

238 \*C AT A DIVISION YOU WOULD EXPECT THE CORPS TO TELL YOU HOW TO  
239 COVER FORCE IF THERE WAS GOING TO BE ONE FOR THE CORPS...

240 \*B [INTERRUPTS] ONLY IF THE CORPS COMMANDER WAS GOING TO RETAIN  
241 CONTROL OF THE COVER FORCE. IF HE WAS GOING TO GIVE ME A SECTOR  
242 GOING ALL THE WAY TO THE BORDER THEN IT'S NONE OF HIS BUSINESS  
243 REALLY WHETHER OR NOT I USE A COVER FORCE.

244 \*C OK SIR.

245 \*A GOT ANY MORE QUESTIONS?

246 \*C IF WE JUMP BACK TO OUR TERMINOLOGY THAT WE'VE BEEN USING UP  
247 TO NOW, THE WHY PART THEN FOR THE CORPS IS TO DESTROY ENEMY  
248 FORCES?

249 \*B NO. IT'S TO DESTROY THE ENEMY FORCES FOR THE PURPOSE OF  
250 GAINING THE INITIATIVE TO ATTACK. THAT'S THE REAL WHY.

251 \*C OK.

252 \*A REMEMBER THAT WE SAID THAT TO BE PREPARED IS ALWAYS A  
253 CONSTRAINT ON WHAT YOU HAVE. AND SURE ENOUGH WE'VE GOT THAT. WE  
254 HAVE TO BE PREPARED TO DO THAT.

255 {DELETED}

256 {DELETED}

257 {DELETED}

258 {DELETED}

259 [\*A TURNS BACK TO THE CAMERA, \*B HAS LEFT THE CAMERA RANGE. A  
260 WIDE VERTICAL LINE HAS BEEN DRAWN ON THE MAP IN THE UPPER RIGHT  
261 QUADRANT NEAR THE CENTER]

262 \*A OK GUYS. DO YOU KNOW WHAT WE HAVE DONE SO FAR?

263 \*C NO SIR.

264 \*A OK LET ME... WE ARE TRYING TO ENVISION THE WAY THE COVERING  
265 FORCE BATTLE WOULD GO. A CAVALRY REGIMENT, IT'S A PRETTY  
266 SIZEABLE OUTFIT. IT'S GOT GOOD COMMUNICATIONS. IT COVERS A LOT  
267 OF GROUND VERY QUICKLY NOT WITHOUT SOME PUNCH AND IT DOES HAVE AN  
268 AIR CAVALRY SQUADRON. WE WOULD LIKE TO GIVE THEM A LITTLE BIT OF  
269 CONTINUITY. AND IN ORDER TO DO THAT WE SET, WHAT WE FELT WAS OUR  
270 FIRST REALLY DEFENSIBLE LINE. WE ADJUSTED YOUR FEBA A LITTLE  
271 BIT. THAT WAS TO GIVE BETTER CONTINUITY IN THE INITIAL DEFENSE  
272 AND TO PROVIDE A LITTLE BIT OF DEPTH FOR THE CAV TO  
273 DEVELOP. NOT A LOT. BUT A LITTLE BIT. PLUS, IF YOU LOOK AT THE  
274 AREA TO OUR NORTH. WHERE THOSE GUYS WOULD PROBABLY ESTABLISH...  
275 SEE THIS CONTINUITY. A HIGHWAY'S THERE. THE IGB GOES BACK...  
276 SO THOSE GUYS UP NORTH WOULD PROBABLY BE DEFENDING ALONG HERE  
277 [POINTS TO UPPER RIGHT QUADRANT NEAR THE CENTER DIRECTLY ABOVE  
278 THE WIDE VERTICAL LINE]. SO THAT ADJUSTMENT; WE'D WORK IT OUT.  
279 IT'S ABOUT THE SAME AS THE SOUTH. IT'S JUST A MATTER OF  
280 ADJUSTMENT IN TERMS OF HOW TO ALLOCATE THE STUFF.

281 \*C IS THERE ANY REASON WHY YOU CHOSE TO WORK ON THE COVERING FORCE  
282 FIRST?

283 \*B THE FACT THAT WE'VE BEEN DICTATED TO HAVE A COVER FORCE.

284 \*C SIR. WHY DID YOU CHOOSE TO WORK ON THAT FIRST BEFORE YOU  
285 LOOKED AT THE MAIN BATTLE AREA?

286 \*A THAT'S THE FIRST THING THAT WILL FIGHT.

287 \*B WHAT YOU'VE GOT TO DO IS SUBDIVIDE THE BATTLEFIELD INTO  
288 COVERING FORCE AREA AND THE MAIN BATTLE AREA. YOU DETERMINE THE  
289 MAIN BATTLE AREA BASED UPON WHERE THE FIRST DEFENSIBLE TERRAIN  
290 WHERE YOU CAN HAVE A CONTINUOUS DEFENSE ESTABLISHED. THAT  
291 BECOMES BY DEFINITION THE FLOT OR OF THE FEBA OR THE MAIN BATTLE  
292 AREA. BY DEFINITION EVERYTHING TO THE BAD GUYS SIDE OF THAT IS  
293 COVERING FORCE AREA. SO, WHILE IT MIGHT HAVE APPEARED THAT WE  
WERE  
294 CONCENTRATING ON THE COVERING FORCE, THE FACT IS WE WERE DRAWING  
295 THE LINE BETWEEN THE MAIN BATTLE AREA AND THE COVERING FORCE  
296 AREA. THAT'S WHAT WE JUST DID. NOW THINGS THAT IMPACT ON THAT  
297 IS YOU LOOK TO THE EAST OF THAT LINE AND SEE WHAT  
298 GIVES US A PROBLEM TERRAIN-WISE IS WHERE THE IGB PULLS BACK RIGHT  
299 HERE [POINTS TO BASE OF LINE]. WHAT I PERSONALLY MIGHT HAVE OPTED TO  
300 DO, AND HE'S CUT MY OPTIONS (MY COMMANDER), I MIGHT HAVE  
301 CONSIDERED, BECAUSE THIS IS PRETTY DARNED TOUGH TERRAIN HERE IN  
302 THE SOUTHERN PART OF THE SECTOR. AND BECAUSE YOU WANT TO KEEP

303 THE BATTLE UNDER THE CONTROL OF A SINGLE COMMANDER WHO CAN  
 304 UNDERSTAND WHAT'S GOING ON ALL THE WAY ACROSS THE BATTLEFIELD.  
 305 PARTICULARLY WHEN YOU'RE WAITING FOR THE BAD GUYS TO ATTACK,  
 306 YOU KNOW WHAT THEY ARE DOING. I MIGHT HAVE CHOSEN TO PUT THE  
 307 CAVARLY DOWN HERE IN AN ECONOMY OF FORCE SECTOR [POINTS TO  
 308 THE RIGHT OF THE BOTTOM OF THE VERTICAL LINE]. I MIGHT HAVE  
 309 WANTED TO DRAW A BOUNDARY THAT WENT SOMETHING LIKE THIS [DRAWS A  
 310 HORIZONTAL LINE NEAR THE BOTTOM OF THE VERTICAL LINE]. IT COMES  
 311 IN HERE AND GIVE THAT TO THE CAV. REGIMENT, AN ECONOMY OF FORCE,  
 312 AND PUT MY TWO DIVISIONS UP HERE [POINTS TO THE TOP RIGHT OF THE  
 313 VERTICAL LINE]. ALL THE WAY FROM TH EIGB, FIGHT THIS BATTLE ALL  
 314 THE WAY BACK BECAUSE THERE'S NOT A NATURAL BREAK TO THE BATTLE  
 315 FLOW AS IT COMES DOWN THROUGH HERE. BUT THE FIRST DEFENSIBLE  
 316 TERRAIN AS YOU COME THROUGH HERE COMES ALONG THE RIVER HERE. THE  
 317 RIVER LEINE COMES UP THROUGH BRAUNSCHWEIG AND THEN CONTINUES ON  
 318 UP THROUGH THE NORTH HERE. THIS IS NOT REAL GOOD DEFENSIBLE  
 319 TERRAIN UP HERE [POINTS TO THE TOP OF THE VERTICAL LINE AND DRAWS  
 320 A MEDIUM SIZE CIRCLE WITH HIS FINGER AROUND THE TOP OF THE LINE].  
 321 THERE'S A LITTLE BIT, BUT, THE COMMANDER WHO OWNS THAT PIECE OF  
 322 DIRT IS GOING TO CONCENTRATE ON MAKING HIM FIGHT HIS WAY THROUGH THESE  
 323 TOWNS AND BUILT UP AREAS AND BOGS AND SWAMPS AND ALL THAT WATER.  
 324 BUT THERE'S NOT GOING TO BE A REAL STRONG CONTINUOUS DEFENSE  
 325 ALONG THAT LINE. WHERE WE ARE NOW, BECAUSE HE HAS DICTATED A  
 326 COVERING FORCE, THIS OPTION ISN'T OPEN TO ME ANY MORE [POINTS TO  
 327 LEFT OF BOTTOM OF LINE]. SO THE PROBLEM YOU RUN INTO NOW IS THE  
 328 DEFENSIBLE TERRAIN IS HERE [POINTS TO UPPER RIGHT QUADRANT  
 329 THE GOOD DEFENSIBLE TERRAIN IN THE  
 330 SOUTH YOU CAN TIE THAT IN TO BRAUNSCHWEIG UP TO ABOUT HERE  
 331 [POINTS TO CENTER RIGHT OF VERTICAL LINE]. GOOD DEFENSIBLE  
 332 TERRAIN HERE [POINTS TO LOWER PART OF LINE, A LITTLE BIT ABOVE  
 333 THE BOTTOM]. GOOD COVERING FORCE OUT HERE [POINTS TO RIGHT OF  
 334 LOWER PART OF LINE]. BUT, WHAT HAPPENS DOWN HERE [POINTS TO LOWER  
 335 RIGHT OF BOTTOM OF LINE]. YOU KNOW AFTER THE FIRST FIGHT, THE  
 336 BATTLE HAS TO BE IMMEDIATELY SHIFTED TO THE MBA FORCE, IF  
 337 THERE WAS A MAJOR ATTACK THAT CAME IN HERE THAT UNHINGED THE  
 338 GUY THAT WAS FIGHTING THE COVERING FORCE DOWN HERE [POINTS TO RIGHT  
 339 SIDE OF BOTTOM OF LINE].

340 \*A OF COURSE THE TERRAIN SUPPORT MOST OF ITS COMING IN HERE  
 341 [POINTS TO AREA TO THE RIGHT OF THE TOP OF THE LINE]. THIS AIN'T  
 342 TOO BAD. THIS ISN'T REAL SHABBY [POINTS TO THE RIGHT OF THE  
 343 BOTTOM OF THE LINE]. SOMETHINGS GOING TO BE COMING ALONG HERE.  
 344 THERE'S PROBABLY GOING TO BE SOME FIGHTING DOWN HERE. THE MBA,  
 345 THE MAIN BATTLE AREA IS GOING TO PICK UP SOME OF THAT, PROBABLY,  
 346 WHILE THE COVERING FORCE BATTLE IS STILL GOING ON. THAT'S A LITTLE  
 347 MESSY.

348 \*B WHAT WILL PROBABLY HAPPEN IF YOU PROJECT THIS THING ON AHEAD  
 349 IS THE REGIMENTAL COMMANDER WHO OWNS THE COVERING FORCE AREA,  
 350 WHOEVER HE'S GOT DOWN HERE [POINTS TO LOWER RIGHT SIDE OF LINE].  
 351 AT THE FIRST FIGHT THIS FORCE IS GOING TO BE CHOPPED TO THIS GUY,  
 352 THIS MBA FORCE COMMANDER RIGHT HERE [POINTS TO LOWER LEFT SIDE OF  
 353 LINE]. HE AND THE REGIMENTAL COMMANDER ARE GOING TO CONCENTRATE  
 354 ON THIS [POINTS TO UPPER RIGHT SIDE OF LINE] FIGHT UP HERE HAVING

355 ALREADY CHOPPED A BOUNDARY THAT RUNS IN HERE SOMEPLACE [POINTS TO  
356 BOTTOM OF LINE AND THEN TO THE LEFT OF THE LINE]. AND THESE GUYS  
357 GET TURNED OVER TO THE MBA COMMANDER.

358 \*C SIR. HAVE YOU ALREADY MADE A DECISION THAT THE CAV REGIMENT  
359 WILL BE THE COVERING FORCE?

360 \*B IT'S THE FORCE MOST SUITED TO DO THAT.

361 \*C ARE THEY STRONG ENOUGH TO COVER THAT WIDE A FRONT?

362 \*B YEAH. PARTICULARLY AS IT'S PITCHED OUT THERE. NOW ANOTHER  
363 SOLUTION TO THE PROBLEM IS: STILL GIVING THE CAV. REGIMENT AN  
364 ECONOMY FORCE MISSION IN THE SOUTH, AND PUTTING TWO DIVISIONS ON  
365 LINE FROM HERE [POINTS TO MIDDLE OF LINE ON THE LEFT SIDE], NORTH  
366 [BRUSHES HAND UP MAP TO THE TOP OF THE LINE STILL ON THE LEFT  
367 SIDE] WITH EACH DIVISION PROVIDING ITS OWN COVER FORCE [POINTS TO  
368 RIGHT UPPER QUADRANT TO THE RIGHT OF THE LINE]. THAT'S ANOTHER  
369 OPTION.

370 \*C WOULD YOU SERIOUSLY CONSIDER THAT SIR? OR IS THERE SOMETHING  
371 IN THERE THAT TELLS YOU THAT'S NOT....?

372 \*B I PERSONALLY HAVE NOT REJECTED ANY OPTION AT THIS POINT.

373 \*C YES SIR. SO AT THIS POINT YOU'VE DETERMINED WHERE THE FLOT  
374 IS? AND YOU'RE DEVELOPING CERTAIN OPTIONS FOR OTHER PARTS OF THE  
375 DEFENSE, BUT NO DECISIONS YET?

376 \*B YES.

377 \*C SO ACTUALLY WE DETERMINED THE WHERE PART FIRST?

378 \*B THAT'S NOT A BAD OPTION DAVE [\*B LOOKS AT \*A]. WHAT HE JUST  
379 SAID.

380 \*B THE REGIMENT IS WELL SUITED TO THIS TERRAIN IN HERE [POINTS  
381 TO LOWER LEFT SIDE OF LINE AND A LITTLE TO THE LEFT OF THAT].  
382 [\*A AND \*B FACING MAP, SOME WORDS UNINTELLIGIBLE]... THE ECONOMY  
383 OF FORCE... IF YOU RAN A DOWNGRADE THAT WENT FROM HERE [PUTS  
384 MARKER TO THE RIGHT SIDE OF THE BOTTOM OF THE LINE] ALONG THERE  
385 [DRAWS HORIZONTAL LINE ACROSS THE BOTTOM OF THE VERTICAL LINE]  
386 AND WE GAVE THAT TO THE REGIMENT AND YOU PUT ANOTHER BOUNDARY BETWEEN  
387 DIVISION UP HERE SOMEPLACE [MARKS VERTICAL LINE A FEW INCHES  
388 DOWN FROM THE TOP]... PROVIDING BRIGADE-SIZE COVERING FORCE OR A  
389 BRIGADE-MINUS-SIZE COVERING FORCE. WE'RE BACK WITH THE  
390 CONTINUITY OF THE BATTLE FLOW FROM THE BORDER BACK... NOT A  
391 STRICT TRANSITION OF THE BATTLE ALONG HERE [RUNS HAND DOWN  
392 VERTICAL LINE] EXCEPT DOWN HERE [HITS MAP AT BOTTOM OF LINE].

393 \*A OUR CONTROL?

394 \*B NO. UNDER DIVISION CONTROL.

395 \*A WE WOULD LOSE THE CONTINUITY AND OUR ABILITY TO KNOW WHAT  
396 THE HELL IS DEVELOPING.

397 \*B NOT REALLY. THE REGIMENTAL COMMANDER DOWN HERE WOULD BE  
398 REPORTING TO THE CORPS, AND THE TWO DIVISION COMMANDERS WOULD BE  
399 REPORTING TO THE CORPS, OR YOU CAN COME WITH A LASH UP THAT HAD  
400 THE DIVISION INCLUDING HIS CAV. SQUADRON PLUS TWO BATTALIONS OR  
401 SO. IF YOU MADE THESE SECTORS NARROW ENOUGH [POINTS TO LEFT  
402 LOWER PART OF LINE] FOR THE TWO DIVISION COMMANDERS I GUESS IS  
403 WHAT I'M TRYING TO SAY. PUT IT IN THERE SOME PLACE [POINTS TO  
404 VERTICAL LINE NEAR THE TOP AND TO THE RIGHT] THAT'S NARROW ENOUGH  
405 THAT HE CAN HAVE A TWO-UP AND ONE-BACK CONFIGURATION AS WELL. WHEREAS  
406 IF HE COVERS THE WHOLE SECTOR AND WE COME UP WITH STILL TRYING TO  
407 DO THE TWO AND ONE AND STILL TRY TO KEEP A CORPS RESERVE AND ALSO  
408 POSTURED SO WE CAN MAKE A SIGNIFICANT COUNTER ATTACK. THEN  
409 YOU'RE TALKING ABOUT A 35KM WIDE SECTOR FOR EACH DIVISION. IT'S  
410 ALMOST GOING TO KEEP HIM FROM BEING TWO UP AND ONE BACK.  
PARTICULARLY IN TERRAIN LIKE THIS.

411 \*A OK LET'S LOOK AT HOW THAT WOULD PLAY BY THE TIME IT GOT TO  
412 THE WESER. BY THAT TIME BACK TO THE WESER IT  
413 EVENS UP AS I SEE IT PRETTY NICELY INTO A TWO DIVISION FRONT. SO WE WOULD  
414 SEE SOMETHING LIKE THIS [PUTS RIGHT HAND ON CENTER OF VERTICAL  
415 LINE, RUNS HAND TO THE LEFT A WAYS], THE CONTINUITY OF THIS [RUNS  
416 HAND ACROSS MAP TO THE LEFT, FROM TOP LEFT OF VERTICAL LINE].  
417 THIS GUY WOULD HAVE TO BREAK OFF [POINTS TO CENTER OF VERTICAL  
418 LINE] THIS GUY IN THIS SECTOR AGAIN [POINTS TO CENTER OF  
419 VERTICAL LINE]. OK THE GROUND FLOWS THAT WAY. PRETTY MUCH.

420 \*B YOU HAVE TO MAKE A DECISION RIGHT THERE [POINTS ROUGHLY TO  
421 THE CENTER OF THE MAP]. HE'S EITHER GOT TO DECIDE TO GO THAT WAY  
422 [DRAWS A LINE NORTHWEST FROM THE CENTER OF THE MAP] OR HE'S GOT  
423 TO CUT THROUGH THIS BAD TERRAIN HERE [POINTS TO LEFT  
424 CENTER OF MAP NEAR A LOT OF BLUE AREA] AND MAKE HIS CROSSING  
425 RIGHT THERE. OTHERWISE HE'S COMING UP HERE [POINTS AT AN ANGLE  
426 FROM THE ABOVE POSITION GOING SLIGHTLY NORTHWEST ABOVE THE BLUE]  
427 AND WE'VE GOT A GOOD STRONG DEFENSIVE LINE ACROSS THERE.  
428 [INDISTINGUISHABLE]... GROUND'S ROUGH IN THERE. SO HE'S GOTTA  
429 COME DOWN HERE [RUNS PEN SOUTHWEST FROM ABOVE FIRST POSITION].

430 \*A WOULD YOU SEE PINCHING HIM OUT... [PAUSES]? I LIKE  
431 THAT. WE COULD PINCH HIM OUT AT THE LEINE. REALLY. SOMETHING  
432 LIKE THIS [CANNOT SEE WHAT \*A IS POINTING AT; HE IS STANDING  
433 DIRECTLY IN FRONT OF WHERE HE IS DRAWING]. IT WOULD LOOK ABOUT  
434 LIKE THIS [POINTING TO MOUNTAINOUS AREA IN CENTER OF MAP, DRAWING  
435 A LINE SLIGHTLY NORTHEAST AND THEN EAST TOWARDS THE VERTICAL  
436 LINE]. THIS GIVES HIM A NATURAL FLOW BACK TO HERE [RUNS HAND  
437 FROM CENTER OF VERTICAL LINE ACROSS PAST THE BLUE AREA IN THE  
438 CENTER OF THE MAP]. THE OTHER GUY HERE [POINTS TO THE LEFT UPPER  
439 QUADRANT OF THE MAP]. HOPEFULLY WE CAN STILL KEEP THE ARMOUR.  
440 LET'S GO. [\*A AND \*B TURN AND FACE THE AUDIENCE.]

441 \*B I LIKE THAT. WE'VE MET THE BOSSES GUIDANCE BY ESTABLISHING  
442 A COVER FORCE. WE'VE MAXIMIZED OUR FLEXIBILITY.

443 \*A IT'S VERY HARD TO DO THIS WITH GREAT PRECISION ON THIS SCALE  
444 OF MAP. AND REALLY AT THIS POINT LITTLE THINGS DO MEAN A LOT;  
445 LIKE BOUNDARIES. AND WHAT WE'RE DOING IS DRAWING IN DIVISION AND  
446 REGIMENTAL BOUNDARIES. I'LL GO AHEAD AND DRAW THESE IN AND HE  
447 CAN EXPLAIN WHAT WE'VE DONE.

448 \*B ARE YOU FOLLOWING THE DECISION PROCESSES THERE [B FACING  
449 INTERVIEWERS].

450 \*C SIR. I HAVE SOME QUESTIONS ABOUT IT. YOU LET ME SEE IF I  
451 CAN RECONSTRUCT IT, IT SEEMS THAT YOU ARE CONCERNED ABOUT THE  
452 NARROWNESS OF, THE LACK OF DEPTH IN THE COVER FORCE AREA IN THE  
453 SOUTH. AND ALSO THAT THE TERRAIN IN THE SOUTH PAST THE COVERING  
454 FORCE AREA WAS ACTUALLY GOOD DEFENSIBLE TERRAIN. AND BECAUSE OF  
455 THAT I GUESS THOSE WERE THE TWO PRINCIPLE REASONS THAT YOU FELT  
456 THAT AN ECONOMY OF FORCE MISSION WAS FEASIBLE DOWN THERE WITH THE  
457 CAV REGIMENT.

458 \*B ANOTHER MAJOR FACTOR IN THAT DECISION PROCESS AND ONE THAT,  
459 REMEMBER I TOLD YOU A WHILE AGO, THAT BY EXPLORING THE WAYS WITHIN  
460 THE ORIGINAL GUIDANCE DICTATES TO SOME DEGREE WHAT YOUR SCHEME UP  
461 HERE IS [POINTS TO MAP]. IT TELLS YOU YOU WANT TO MAINTAIN  
462 FLEXIBILITY. ONE OF THE WAYS YOU GAIN FLEXIBILITY IS DEFENDING  
463 ON A NARROWER SECTOR. A SECTOR NARROWER IN FACT THAN YOUR  
464 FORCE IN FACT CAN DEFEND. SO YOU TAKE A COMBINATION OF THE  
465 TERRAIN IN THE SOUTH, THE WIDTH OF THE SECTOR NORTH OF THAT  
466 TERRAIN AND YOU CUT THAT IN HALF THEN WHAT YOU'VE GIVEN THE  
467 DIVISION COMMANDERS IS FLEXIBILITY FOR THEM TO MAINTAIN THEIR OWN RESERVE.

468 \*C YES SIR.

469 \*B NOW THE CONTINUITY OF THE BATTLE, THE FLOW OF THE BATTLE  
470 FROM THE IGB BACK TO HERE [POINTS TO TOP OF VERTICAL LINE AND  
471 RUNS HAND TO THE LEFT TOWARD THE LEFT UPPER QUADRANT] IS ALL  
472 UNDER THE ONE GUYS CONTROL. IF YOU'VE GOT A COVERING FORCE OUT  
473 THERE, SAY A CORPS CONTROL COVERING FORCE, AND THE CAV REGIMENT  
474 THERE'S A DEFINITE BREAK IN THE BATTLE RIGHT HERE [PUTS HAND  
475 ALONG THE TOP OF THE VERTICAL LINE]. AS YOU SWITCH CONTROL OF THE  
476 BATTLE FROM A REGIMENTAL OR SQUADRON COMMANDER TO THE DIVISION  
477 COMMANDER OR THE BRIGADE COMMANDER. WHEREAS IN THIS CASE,  
478 HOWEVER, I WOULD NOT TELL THE DIVISION COMMANDER, I WOULD TELL HIM  
479 TO ESTABLISH A COVER FORCE OR CONDUCT COVERING FORCE OPERATIONS  
480 FROM THE IGB TO THE FEBA AND MAKE HIS MAIN DEFENSE BEGIN ON  
481 THE FEBA. IT'S UNDER HIS CONTROL. SAME THING FOR THIS GUY  
482 [POINTS TO RIGHT OF CENTER OF VERTICAL LINE]. IN HERE,  
483 FROM HERE, WHEN HE CROSSES THE IGB HE'S IN THE MBA. SO THERE'S NO  
484 WAY YOU CAN HAVE A TRANSITION OF BATTLE AT THE SAME TIME YOU HAVE  
485 A MAJOR ATTACK. THAT'S IN FACT DISASTER. THAT'S WHY WE  
486 DECIDED TO MAKE THIS A CONTINUOUS BATTLE THROUGH HERE [POINTS  
487 TOWARDS THE CENTER OF THE MAP]. THE CAV REGIMENT BECAUSE IT'S  
488 VERY MOBILE. HAS ITS OWN FIRE SUPPORT. HAS A GOOD ABILITY TO  
489 FIGHT SMALL BATTLES WITH UNIT INTEGRITY. THERE IS GOING TO BE A  
490 LOT OF SMALL BATTLES THAT HAPPEN RIGHT IN HERE BECAUSE OF THE

491 NATURE OF THE TERRAIN. THERE ARE A LOT OF HILL MASSES IN HERE.  
 492 HE IN FACT CAN FIGHT A HELL OF A BATTLE RIGHT THROUGH HERE  
 493 [POINTS TO LEFT OF BOTTOM OF VERTICAL LINE]. THE REGIMENT CAN.  
 494 A SQUADRON CANT. FROM THE REGIMENTAL PERSPECTIVE, HE MAY CHOOSE  
 495 TO PUT, PROBABLY INITIALLY, TWO SQUADRONS UP, WITH A SQUADRON IN  
 496 RESERVE AND HE WILL FIGHT THOSE TWO SQUADRONS AGAINST EACH  
 497 OTHER. IF THE MAIN ATTACK COMES HERE [POINTS TO BOTTOM OF  
 498 VERTICAL LINE] HE'LL HAVE A SQUADRON HOLDING DOWN HERE [POINTS TO  
 499 THE BOTTOM OF THE VERTICAL LINE] AND A SQUADRON HOLDING DOWN HERE  
 500 [POINTS TO A FEW INCHES ABOVE THE BOTTOM OF THE VERTICAL LINE]  
 501 AND THIS GUY [POINTS TO BOTTOM OF VERTICAL LINE], IF HE'S FREE  
 502 PART OF HIM MAY ATTACK INTO THE FLANK RIGHT HERE. AND HE'S STILL  
 503 HOLDING A SQUADRON IN RESERVE BACK HERE [POINTS TO ABOUT SIX  
 504 INCHES TO THE LEFT OF THE BOTTOM OF THE VERTICAL LINE]. SO THE  
 505 REGIMENTAL COMMANDER CAN FIGHT A GOOD FIGHT ALL THE WAY BACK  
 506 THROUGH HERE [POINTS TO LEFT OF BOTTOM OF VERTICAL LINE].

507 \*A [NOT AUDIBLE] AND PROBABLY JUST FOR CONTROL. THE CORPS  
 508 USUALLY DRAWS IN SOME CONTROL MEASURES. BUT, OUR MAIN DEFENSE IS  
 509 GOING TO BE ALONG LINE ZULU. BUT THIS RIVER LINE HERE... AGAIN,  
 510 DIVISIONS ARE GOING TO JOIN OTHERS. IT WILL BE NO GREAT THING.  
 511 WE'LL PROBABLY CALL THIS LINE XRAY [DRAWING LINE TO LEFT OF  
 512 BOTTOM OF VERTICAL LINE ABOUT 12 INCHES FROM LINE]. THIS IS  
 513 WHERE OLD TOM AND I WILL START MAKING DECISIONS. ONCE THINGS  
 514 GOT BACK ALONG THIS WAY WE'D REALLY START LOOKING AT THIS LITTLE  
 515 PINCH OUT THING; SEEING IF THESE GUYS WERE HAVING ANY TROUBLE  
 516 GETTING WHERE WE WANT THEM TO GO ALONG THE WESER. FOLLOWS THAT  
 517 RIVER LINE [POINTS TO A NORTH TO SOUTH RUNNING RIVER IN THE UPPER  
 518 LEFT QUADRANT]. CAUSE YOU MENTALLY DRAW IN DECISION POINTS,  
 519 CRITICAL PARTS OF THE BATTLE, WE'LL BE HAVING COFFEE TILL AROUND  
 520 HERE [POINTS TO AREA ABOUT 8 INCHES TO LEFT OF BOTTOM OF THE  
 521 VERTICAL LINE]. WE'LL TAKE A LOOK AT THIS FOR A LITTLE BIT  
 522 [POINTS TO LEFT OF UPPER PART OF VERTICAL LINE]. WE'LL GO  
 523 OUTSIDE THE TOC AND TAKE A LOOK AROUND.

524 \*B THE FIRST CORPS BATTLE IS BACK HERE AT FEBA [POINTS TO LEFT OF TOP OF  
 525 LINE] THE MBA FORCES WILL BE DEPLOYING ALONG HERE [FEBA] THE DIVISION  
 526 CONTROL COVERING FORCE IS HERE [POINTS TWO FINGERS COVERING AN AREA  
 527 ABOUT 3 INCHES LONG TO RIGHT OF TOP OF LINE AND DOWN] AND HERE  
 528 [POINTS TO FINGERS COVERING AN AREA ABOUT 3 INCHES LONG TO RIGHT  
 529 OF CENTER OF LINE AND DOWN]. THE REGIMENT'S GOT HERE [POINTS TO  
 530 BOTTOM LEFT OF THE VERTICAL LINE]. THE DIVISION COMMANDERS WILL  
 531 FIGHT THIS FIGHT BACK TO ALONG HERE [POINTS TO AREA ABOUT 8 INCHES  
 532 TO LEFT OF THE TOP OF THE VERTICAL LINE]. THERE'S  
 533 MAYBE...PROBABLY TO LINE X-RAY [POINTS IN GENERAL AREA OF  
 534 THE WESER RIVER]. IS THE FIRST PLACE CORPS COMMANDER IS GOING TO MAKE  
 535 CRITICAL DECISIONS.

536 \*A AND THIS, TO US, WOULD BE, AND THIS IS NO DEFINITION, CALL  
 537 THIS A PIVOT POINT [POINTS TO LEFT UPPER QUADRANT]. THAT'S WHEN  
 538 I WOULD SAY, "WELL LET'S SEE TOM, WHERE ARE THE GUYS IN THE  
 539 NORTH? WHERE ARE THE GUYS IN THE SOUTH? ARE THESE GUYS WAY UP  
 540 HERE WHILE THESE GUYS ARE WAY BACK HERE? ARE WE GOING TO BE

541 ABLE TO... YOU KNOW?

542 \*B WHAT ARE YOU GOING TO HAVE TO DO AT LINE XRAY TO BE PROPERLY  
543 POSTURED AT LINE ZULU TO MAKE A MAIN DEFENSE? WHICH IS  
544 WHAT YOU'VE BEEN TOLD TO DO.

545 \*A WE CAN STILL MAKE SOME CHANGES HERE IF WE HAVE TO [POINTS TO  
546 CENTER OF MAP A LITTLE BIT TO THE NORTH]. ONCE IT GETS BACK HERE  
547 WE WOULD BE MESSING THINGS UP AT THAT POINT BY CHANCE. BECAUSE  
548 WE'VE STILL GOT QUITE A WAYS. REALLY. THAT'S A PIVOT POINT. WE  
549 SEE THAT. THAT'S WHERE A BUNCH OF DECISIONS ARE GOING TO BE  
550 MADE. THAT'S NOT IN THE ORDERS. THAT'S NOT WRITTEN DOWN  
551 ANYWHERE. IN FACT I DON'T THINK WE'VE DISCUSSED THAT BEFORE.  
552 HAVE WE? BUT AS YOU LOOK AT THE BATTLEFIELD, A VERY INTENSE  
553 LOOK, AS PEOPLE START COMING ALONG LINE XRAY [POINTS TO RIVER  
554 LINE RUNNING NORTH TO SOUTH IN UPPER LEFT QUADRANT]. BECAUSE THIS IS WHAT  
555 WILL FACILITATE... [PAUSES]

556 \*C SO WHAT IS IT ABOUT, IS IT THE TERRAIN AROUND LINE XRAY THAT  
557 YOU'VE SPOKEN OF? YOU SAID IT JUMPS RIGHT OUT AT YOU.

558 \*B YEAH. THERE'S ONE BATTLE, THE BATTLE... THIS IS ALL ONE  
559 BATTLE UP TO HERE [PUTS HAND IN RIGHT UPPER QUADRANT ABOUT SIX  
560 INCHES TO THE RIGHT OF THE VERTICAL LINE, RUNS HAND ACROSS LINE  
561 TO ABOUT 6 INCHES TO THE LEFT OF THE TOP OF THE LINE]. THE BATTLE  
562 CHANGES COMPLEXION RIGHT HERE.

563 \*C IS THAT BECAUSE YOU'RE ENCOUNTERING BUILT UP AREAS AND ...

564 \*B BUILT UP AREAS AND A COMBINATION OF THESE RIDGE LINES  
565 THAT STICK OUT THROUGH HERE [POINTS TO CENTER OF MAP IN A  
566 MOUNTAINOUS AREA] GOOD DEFENSIBLE TERRAIN UP TO HERE [RUNS  
567 FINGER NORTHWEST ABOVE MOUNTAINOUS REGION]. THEN IT'S MARSHY UP  
568 THERE WHICH IS SOMEWHAT OF AN OBSTACLE. THAT'S THE MAIN OBSTACLE  
569 THE CITY OF HANNOVER. BUT THE BATTLE CHANGES COMPLEXION RIGHT  
570 HERE [PUTS HAND ON AREA NEAR CITY OF HANNOVER IN THE LEFT UPPER  
571 QUADRANT].

572 \*A AND ROAD NETWORK. SO, THE REASON WE'VE GOT THE ECONOMY OF  
573 FORCE RIGHT HERE IS BECAUSE NOTHING IN HERE GOES INTO ANYTHING [POINTS  
574 TO AREA TO LEFT OF THE BOTTOM OF THE VERTICAL LINE]. SO A  
575 REGIMENT WILL DO THAT.

576 \*B ANOTHER THING A REGIMENT DOES FOR YOU HERE...

577 \*A [INTERRUPTS] THIS SUPPORTS A LOT OF STUFF. THESE ROADS  
578 CLEARLY... [PAUSES]

579 \*B REMEMBER THIS FLANK THREAT? THE REGIMENT IS PERFECTLY  
580 POSTURED TO TAKE CARE OF THAT. IF THIS GUY ATTACKS DOWN HERE  
581 [POINTS TO LOWER RIGHT QUADRANT OF MAP WAY BELOW DEFENSIVE LINE],  
582 THE MAIN ATTACK. THEN WE'VE GUESSED WRONG. THE MAIN ATTACK IS  
583 COMING RIGHT UP THROUGH HERE [ANGLES UP AND COMES UP BEHIND  
584 VERTICAL LINE] WE'VE GOT A MAJOR FORCE UNDER THE CONTROL OF ONE  
585 COMMANDER THAT YOU CAN CHOP TO THAT WHILE YOU'RE REACTING. YOU

586 COULD VERY EASILY IF NECESSARY; IF THIS THREAT BECAME TOO BIG  
587 YOU COULD THEN CHOP THIS SECTOR [POINTS TO LEFT OF BOTTOM OF VERTICAL LINE].  
588 YOU'D ELIMINATE THIS BOUNDARY. YOU CAN GIVE CONTROL OF THIS  
589 [POINTS TO LEFT OF THE BOTTOM OF THE VERTICAL LINE] TO THIS  
590 DIVISION COMMANDER [POINTS TO CENTER OF VERTICAL LINE] AND HE'D  
591 PROBABLY RUN HIS RESERVE BRIGADE DOWN THERE [POINTS TO RIGHT  
592 LOWER QUADRANT OF MAP]. PUT YOUR CAV REGIMENT COMMANDER ON THIS  
593 THING [POINTS TO LEFT OF CENTER OF MAP] COMING INTO THE FLANK  
594 HERE.

595 \*A NOW WHAT HAVE WE NOT DONE? WHAT HAVE WE TRIED TO AVOID?  
596 WE'VE TRIED TO AVOID THE USE OF OUR RESERVE FORCE. WE'VE NARROWED  
597 THOSE SECTORS BY SQUEEZING THESE THINGS... BY USING HIM IN AN  
598 ECONOMY OF FORCE WE'VE NARROWED THESE SECTORS GIVING HIM MORE  
599 PUNCH. NOW THE MORE YOU CAN SQUEEZE IT THE MORE PUNCH YOU'VE  
600 GOT. PEOPLE CALL IT TWO BRIGADES UP AND ONE BRIGADE BACK. BUT,  
601 IT KEEPS US... UNDERSTAND THAT THE BOSS BASICALLY WANTS US TO  
602 COUNTERATTACK. WE'VE STILL GOT A DIVISION NOT COMMITTED AND IT  
603 PROBABLY WON'T HAVE TO BE COMMITTED. YET, IF HE DOES HAVE TO BE  
604 COMMITTED WE WOULD PROBABLY SEE THE MORE DECISIVE COMMITMENT  
605 HERE ALONG THE WESER. SO WE'VE DONE TWO THINGS: WE'VE PRESERVED  
606 OUR FORCE, WE'VE TRIED TO ATTRIT FORWARD; AND WE'RE PREPARING FOR  
607 A CONTINGENCY TO COUNTERATTACK.

608 \*B WE'VE GOT ENOUGH FORCE UP THERE TO DEVELOP THE BATTLE. WE  
609 SHOULD BE ABLE TO IDENTIFY WHERE THE MAIN ATTACK IS COMING  
610 FROM.

611 \*A WE KIND OF LOSE THE FEEL FOR THE MAGNITUDE OF THIS BECAUSE OF  
612 THE RELATIVELY SMALL SCALE MAP. FROM HERE TO HERE ARE 70KM  
613 [POINTS TO LEFT UPPER QUADRANT OF MAP ABOUT 12 INCHES TO  
614 THE LEFT OF THE TOP OF THE VERTICAL LINE AND THEN POINTS THE SAME  
615 DISTANCE FROM THE BOTTOM OF THE LINE]. DISTANCE BETWEEN BOUNDARIES.

616 \*C YES SIR. LET ME ASK THIS QUESTION. APPARENTLY FROM WHAT I  
617 UNDERSTAND, ONE OF THE CRITICAL THINGS YOU'RE TRYING TO DO IS TO  
618 KEEP A RESERVE UNCOMMITTED. IT APPARENTLY SEEMS TO BE ONE OF THE...

619 \*B EVEN IF WE DID NOT HAVE THE CONTINGENCY TO BE PREPARED TO  
620 ATTACK I WOULD STILL ATTEMPT TO MAINTAIN ONE THIRD OF MY FORCE  
621 UNCOMMITTED. TO GIVE ME THE FLEXIBILITY TO DESTROY THE ENEMY  
622 FORCES IN SECTOR. WHICH IS THE FIRST MISSION THAT MY BOSS GAVE  
623 ME.

624 \*A NOW THIS IS AN OLD, TRADITIONAL, CONVENTIONAL WAY OF SEEING  
625 THINGS AND TOMMY AND I AGREE ON IT. WE WENT THROUGH A PERIOD  
626 WHERE EVERYTHING WAS FORWARD AND YOU DIDN'T HAVE A RESERVE. THE  
627 RESERVE CAME OUT OF SOMEBODY NOT COMMITTED. WE WERE NEVER  
628 COMFORTABLE WITH THAT. THERE'S A SWING. THINGS HAVE SWUNG BACK  
629 THE OTHER WAY. TO TRY TO KEEP SOMETHING THAT YOU CAN BE DECISIVE  
630 WITH. WHATEVER. I FEEL PRETTY GOOD ABOUT THAT. I FEEL THAT EVEN  
631 IF HE... A MAJOR RUPTURE... WHICH HE COULD TRY TO DO WITH ALL  
632 THESE NUKES AND ALL. I'VE GOT A DIVISION TO PLUG IT. AN  
633 ARMoured DIVISION.

634 \*B WE'RE TALKING SIX TANK BATTALLIONS.

635 \*A WE HAVEN'T GIVEN YOU OUR TASK ORGANIZATION YET, BUT, WE'VE  
 636 GOT ONE PRETTY WELL UNDER WAY. IN FACT WE HAVE OUR TASK  
 637 ORGANIZATION. REMEMBER WE SAID IT SORT OF TAKES PLACE  
 638 CONCURRENTLY AS YOU START LOOKING AT HOW YOU WANT TO GO ABOUT  
 639 THIS STUFF? SEE YOU CAN'T DO THIS AND THEN SAY, "NOW WE WILL DO  
 640 OUR TASK ORGANIZATION." WHAT WE WILL DO NOW IS TIDY UP OUR TASK ORGANIZATION  
 641 I MEAN WE MIGHT WANT TO FUSS A LITTLE BIT ABOUT, WELL, WE'LL GIVE  
 642 THIS TO THAT ONE AND GIVE THIS TO THE OTHER ONE. WHAT WE'RE  
 643 SEEING RIGHT NOW IS A MECH TO THE NORTH AND A MECH TO THE SOUTH  
 644 AND ARMoured IN RESERVE.

645 [\*A AND \*B TURN BACK TO THE MAP, TALKING FAST AND QUICKLY DRAWING  
 646 LINES ON THE MAP]

647 \*C SO THIS IS VERY FAST. COMPARED TO THE EXERCISES WE'VE SEEN  
 648 ON TAPE BEFORE, WHICH ARE THE SAME SITUATION. IN POSITIONING YOUR  
 649 RESERVE YOU'RE REALLY CONSIDERING TWO THINGS. ONE IS YOUR ABILITY  
 650 TO USE THE RESERVE IN THE DEFENSE AND THE SECOND ONE IS THE  
 651 ABILITY TO LAUNCH A COUNTERATTACK FROM WHERE THEY ARE.

652 \*B YOU ALWAYS LOOK FOR A PLACE YOU CAN PUT IT; A PLACE YOU CAN FIT.  
 653 YOU'VE GOT TO LOOK AT WHAT ARE ALL THE POSSIBILITIES OF YOUR  
 654 UTILIZATION OF IT. AND THEN YOU EXAMINE THE TERRAIN, THE  
 655 SITUATION, YOUR DEPLOYMENT AND THE FEASIBILITY STANDPOINT OF  
 656 DOING ALL THOSE THINGS AND IT KIND OF FALLS OUT AT YOU.

657 \*A LET'S TAKE A LOOK AGAIN. NOW YOU HAVE TO COME UP HERE TO THE  
 658 MAP TO SEE IT. OK, NOW, THIS IS A MAJOR HIGH SPEED AVENUE OF  
 659 APPROACH [POINTS TO AUTOBAHN GOING FROM EAST TO WEST ACROSS THE  
 660 MAP]. NOT GOING ANYWHERE. IT GOES RIGHT INTO HANNOVER WHICH IS  
 661 A MESS. I MEAN, IT'S A MAJOR CITY. BUT, YOU KNOW, THERE'S STILL  
 662 A LOT OF THESE ROUTES [POINTS TO ROUTES NORTH OF THE AUTOBAHN].  
 663 THESE ARE SIGNIFICANT. WE'RE NOT INDIFFERENT TO THIS. WE'RE  
 664 TRYING TO THINK LIKE THE OTHER GUY. WE'VE GOT FEWER OBSTACLES  
 665 ALONG IN HERE. YOU'VE GOT CANALS, YOU'VE GOT THE CROSSINGS, THE  
 666 AUTOBAHN CROSSES IT. SO WE THINK, WE PROBABLY WILL MAKE OUR RUN  
 667 THIS WAY [POINTS TO AN AREA OF THE MAP]. BUT, HE'S  
 668 GOING TO PUT MAJOR FORCES IN HERE. SO A DIVISION UP HERE  
 669 [POINTS TO MAP A LITTLE LEFT OF THE TOP OF THE VERTICAL LINE].  
 670 NOW THIS DIVISION HAS A NARROWER SECTOR THAT HELPS BEEF IT UP  
 671 AND BEHIND THIS DIVISION SITS A RESERVE [POINTS TO ARMoured DIVISION  
 672 SYMBOL TO THE LEFT OF THE CENTER OF THE MAP]. NOW EVEN THOUGH THE  
 673 RESERVE IS AWAY FROM HIM, IT STILL BEEFS HIM UP. NOW, WE'RE  
 674 GOING TO PINCH THIS GUY OUT [POINTS TO LEFT OF BOTTOM OF VERTICAL  
 675 LINE]. THIS GUY COMES BACK AND DEFENDS ALONG THE RIVER [POINTS TO  
 676 LEFT OF CENTER OF VERTICAL LINE]. WHAT IF HE DOESN'T MAKE IT?  
 677 WHAT IF THE MAJOR ATTACK DOES COME ALONG THIS WAY [POINTS TO  
 678 RIGHT LOWER QUADRANT AND RUNS HAND UP IN A NORTHWESTERLY  
 679 DIRECTION]? SEE, WE'VE GOT PIVOT POINTS. WE'VE NOT STUCK. WE'VE  
 680 GOT PLENTY OF OPTIONS. AND A GOOD OPERATOR DOES THAT. WE'VE GOT  
 681 OPTIONS HERE. HE'S AN OPTION [POINTS TO LEFT OF CENTER OF

682 VERTICAL LINE]. HE'S AN OPTION [POINTS TO TANK BATTALLION IN  
 683 RESERVE]. HELL, SOMETHING UP HERE COULD BE AN OPTION [POINTS TO  
 684 ABOUT 6 INCHES TO THE LEFT OF THE TOP OF THE VERTICAL LINE].  
 685 MAYBE HE'S NOT DOING ANYTHING. SO WE CAN SAY SEND 2 BRIGADES OR  
 686 A BRIGADE. SO WE KEEP FLEXIBILITY THROUGHOUT, AND YOU DO  
 687 THAT A LOT BY, YOUR BOUNDARIES HELP OF COURSE, BUT YOUR POSITION  
 688 IS A BIGGEE. THESE GUYS, NOW IF THE MAIN ATTACK COMES HERE  
 689 [POINTS TO RIGHT LOWER QUADRANT AND UP NORTHWESTERLY]. THESE  
 690 GUYS COULD GO IN THERE AND BLOCK IT. WE COULD CHOP THESE GUYS TO  
 691 THEM [POINTING NEAR THE CENTER OF THE MAP].

692 WHAT IF THIS IS A CORPS ATTACK, OR AN ARMY GROUP ATTACK  
 693 I DON'T THINK IT WOULD BE BUT IT'S A SIGNIFICANT... SOMETHING  
 694 BIGGER COULD DEVELOP LIKE THIS [POINTS TO RIGHT LOWER QUADRANT  
 695 AND SHOWS A WIDER FRONT COMING UP]. SO, THIS GIVES US  
 696 FLEXIBILITY WITH THESE GUYS. NOW, WHAT IF EVERYTHING GOES  
 697 ACCORDING TO PLAN AND WE DON'T GET THESE DIVISION CHOPPED UP THEY  
 698 BOTH CAN BACK HERE [POINTS TO UPPER LEFT QUADRANT] AND OCCUPY A  
 699 COHERENT DEFENSE ALONG THE WESER. WE'RE HOPING THEY CAN. WE THINK  
 700 THEY CAN. THEN THAT WOULD LEAVE US AGAIN POISED TO DO THE SECOND,  
 701 THE THIRD, THING WE WERE TOLD TO DO. TO BE PREPARED TO GO ATTACK  
 702 MAGDEBURG.

703 \*B AND I WOULD POINT OUT AT THAT POINT YOU WOULD STILL HAVE A  
 704 RESERVE. EVEN IF YOU COMMITTED THE 4TH ARMOUR DIVISION BECAUSE  
 705 THE CAV REGIMENT HAS BEEN PINCHED OUT.

706 \*A THEN I AM POISED WELL TO CONDUCT THAT COUNTERATTACK IF I HAVE  
 707 TO. IF ONE OF THESE GUYS IS TAKING HEAVY DAMAGE. THEN I'M POISED WELL TO GO AND  
 708 REINFORCE HIM. I'LL KNOW THAT BY THE TIME THEY GET BACK TO LINE X-RAY. THAT'S  
 709 WHY I SAID HE AND I WOULD START EASING UP TOWARDS THE MAP WHEN  
 710 PEOPLE GET JUST OUTSIDE OF LINE XRAY.. BECAUSE THAT'LL BE THE  
 711 DECISION TIME. BIG TIME DECISION. WE MAY, WE MIGHT HAVE TO MOVE  
 712 THE RESERVE FORWARD. DON'T WANT TO. BUT, THAT WE THINK, UH...

713 \*B THERE'S EVEN THE POSSIBILITY OF MOVING THE 4TH ARMoured  
 714 DIVISION FURTHER TO THE WEST. IF THE DEFENSE IS GOING WELL FOR  
 715 BOTH THE 80TH AND THE 90TH. THEN YOU JUST LET THEM FIGHT THEIR  
 716 WAY ON BACK THERE. IF YOU WANT TO KEEP THE 4TH ARMoured DIVISION  
 717 ABSOLUTELY UNSCATHED THEN LET THEM CONTINUE THAT FIGHT BACK  
 718 THERE.

719 \*D YOU'VE ALREADY SPOKEN ABOUT HOW YOU DECIDE WHAT SIZE YOUR  
 720 RESERVE SHOULD BE, ROUGHLY ONE THIRD OF YOUR TOTAL FORCES...

721 \*B THAT'S A GENERAL RULE.

722 \*D AND YOU'VE SPOKEN ABOUT, AT LEAST IN THIS CASE, WHERE YOU  
 723 WOULD POSITION THEM AND WHY. WHAT FACT IN GENERAL, WHAT FACTORS  
 724 ARE TAKEN INTO CONSIDERATION IN DECIDING WHICH UNITS WOULD  
 725 COMPRISE THE RESERVE? AND THEN, WHAT WERE THEY IN THIS  
 726 PARTICULAR...?

727 \*B WE CHOSE THE RESERVE BASED ON ITS PUNCH. THERE'S NOT MUCH  
 728 DIFFERENCE BETWEEN A MECHANIZED INFANTRY DIVISION AND AN ARMoured

729 DIVISION EXCEPT THAT AN ARMoured DIVISION HAS SIX TANK  
730 BATTALLIONS. WHEREAS A MECH DIVISION HAS ONLY GOT FIVE. THE  
731 MECH DIVISION IS FIVE TANK, FIVE MECH. THE ARMoured DIVISION HAS  
732 SIX TANKS AND FOUR MECH. WHICH MEANS THAT YOU'VE GOT MORE ARMOUR  
733 PUNCH TO GO INTO A DEEP ATTACK WITH THE ARMoured DIVISION. THE  
734 ADDITIONAL CONSIDERATION IS IN THE MBA. THERE ARE LOTS OF GOOD  
735 PLACES THERE BECAUSE OF ALL THESE MARSHES AND BOGS AND ALL THAT  
736 KIND OF STUFF, TO PUT DISMOUNTED INFANTRY IN THOSE BUILT-UP  
737 AREAS AND PLACES LIKE THAT TO CONDUCT A GOOD DEFENSE. BUILT-UP  
738 AREAS AREN'T WHERE YOU WANT TANKS. SO YOU'VE GOT MORE INFANTRYMEN  
739 UP THERE IN THOSE TWO MECH DIVISIONS THAN YOU HAVE IN THE  
740 ARMoured DIVISION.

741 \*A THERE IS ONE INTANGIBLE. AND THIS GOES RIGHT BACK TO  
742 SOMETHING ELSE WE TOLD YOU. WE LIKE TO KEEP ARMOUR IN RESERVE  
743 BECAUSE OF THE DIFFERENT MENTALITY WITHIN THE ARMoured DIVISION'S  
744 TOC. IF THESE THREE DIVISION KNEW WHAT THE CORP ORDER WAS,  
745 BEFORE WE EVER EVEN CAME AND SAW THEM THEY WOULD PROBABLY ALREADY  
746 HAVE THEMSELVES IN PLACE. BECAUSE, ARMoured DIVISIONS ARE USED TO  
747 BEING EMPLOYED IN A DECISIVE MANNER AND A RESERVE IS THE DECISIVE  
748 FACTOR.